



Using Multilink PPP over Serial Interface Links

First Published: May 2, 2005
Last Updated: July 18, 2008

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

Finding Feature Information in This Module

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the [“Feature Information for Using Multilink PPP over Serial Interface Links”](#) section on [page 11](#).

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

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Prerequisites for Using Multilink PPP over Serial Interface Links

Knowledge

- Be familiar with the concepts in the “[Reducing Latency and Jitter for Real-Time Traffic Using Multilink PPP](#)” module.

Enable Queueing Mechanism

- Multilink uses first-in first out (FIFO) queuing for queuing and interleaving packets. Other queuing mechanisms such as low latency queuing (LLQ), weighted fair queuing (WFQ), and class-based weighted fair queuing (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 Serial Interface Links

Number of Links per Multilink Bundle

If a multilink bundle has one link or packet order is not important for interleaved packets, use Link Fragmentation and Interleaving (LFI) without multiclass. Use LFI with multiclass if a multilink bundle has multiple links.

VoIP Support

Only Voice over IP (VoIP) is supported.

Queueing Mechanisms Not Supported

Many of the legacy queuing mechanisms are not supported by multilink. These mechanisms include:

- Fair queuing on a virtual template interface
- Weighted random early detection (WRED) on a virtual template interface
- Custom queuing
- Priority queuing



Note Fair queuing, WRED, and priority queuing can be configured in a traffic policy using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).

Information About Using Multilink PPP over Serial Interface Links

To use Multilink PPP over serial interface links, you should understand the following concept:

- [MQC and Multilink PPP over Serial Interface Links, page 3](#)
- [Multilink Group Interfaces, page 3](#)

MQC and Multilink PPP over Serial Interface Links

Before using Multilink PPP over serial interface links, a traffic policy (also known as a policy map) must be created. (See the [“Prerequisites” section on page 3](#).) Policy maps are created using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).

The MQC is a CLI structure that allows users to create traffic policies (policy maps) and attach these policy maps to interfaces. A policy map contains a traffic class and one or more QoS features. A traffic class is used to classify traffic. The QoS features in the traffic policy determine how to treat the classified traffic.

For more information about MQC, see the [“Applying QoS Features Using the MQC”](#) module.

Multilink Group Interfaces

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

For more information about multilink group interfaces and multilink groups, see the [“Configuring Media-Independent PPP and Multilink PPP”](#) module.

How to Configure Multilink PPP over Serial Interface Links

This section contains the following procedures:

- [Configuring Multilink PPP over Serial Interface Links on a Multilink Group Interface, page 3](#) (required)
- [Associating the Serial Interface with the Multilink Group, page 5](#) (required)
- [Verifying the Multilink PPP over Serial Interface Link Configuration, page 6](#) (optional)

Configuring Multilink PPP over Serial Interface Links on a Multilink Group Interface

To configure Multilink PPP over serial interface links on a multilink group interface, complete the following steps.

Prerequisites

Before proceeding with this task, you must create a policy map. The policy map contains the configuration parameters used to apply the specific quality of service feature to the network traffic. To create a policy map, use the MQC. See the [“MQC and Multilink PPP over Serial Interface Links” section on page 3](#).

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. <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 multilink <i>multilink-bundle-number</i> Example: Router(config)# interface multilink 1	Creates a multilink bundle and enters interface configuration mode. <ul style="list-style-type: none"> Enter the multilink bundle number.
Step 4	ip address <i>ip-address mask</i> [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. <ul style="list-style-type: none"> Enter the primary IP address (and, optionally, the secondary IP address).
Step 5	service-policy output <i>policy-map-name</i> Example: Router(config-if)# service-policy output policy1	Attaches the previously created QoS traffic policy (policy map). See the “Prerequisites” section on page 3 . The policy map evaluates and applies QoS features for traffic <i>leaving</i> the interface. <ul style="list-style-type: none"> Enter the policy map name.
Step 6	service-policy input <i>policy-map-name</i> Example: Router(config-if)# service-policy input policy1	Attaches the previously created QoS traffic policy (policy map). See the “Prerequisites” section on page 3 . The policy map evaluates and applies QoS features for traffic <i>entering</i> the interface. <ul style="list-style-type: none"> Enter the policy map name.
Step 7	ppp multilink fragment delay <i>milliseconds</i> <i>[microseconds]</i> 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. <ul style="list-style-type: none"> Enter the maximum amount of time, in milliseconds.

	Command or Action	Purpose
Step 8	<code>ppp multilink interleave</code> Example: Router(config-if)# ppp multilink interleave	Enables interleaving of packets among the fragments of larger packets on a multilink bundle.
Step 9	<code>ppp multilink multiclass</code> 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	<code>end</code> Example: Router(config-if)# end	(Optional) Exits interface configuration mode.

Associating the Serial Interface with the Multilink Group

To associate the serial interface with the multilink group, complete the following steps.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface serial slot/port:timeslot`
4. `no fair-queue`
5. `encapsulation ppp`
6. `ppp multilink`
7. `ppp multilink group group-number`
8. `end`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code> Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<code>configure terminal</code> Example: Router# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<pre>interface serial slot/port:timeslot</pre> <p>Example: Router# interface serial 4/1:23</p>	<p>Specifies a serial interface created on a channelized E1 or channelized T1 controller (for ISDN PRI, channel-associated signaling, or robbed-bit signaling), and enters interface configuration mode.</p> <ul style="list-style-type: none"> Enter the slot number and port number where the channelized E1 or T1 controller is located.
Step 4	<pre>no fair-queue</pre> <p>Example: Router(config-if)# no fair-queue</p>	<p>Disables WFQ (or DWFQ for VIP-enabled routers).</p>
Step 5	<pre>encapsulation ppp</pre> <p>Example: Router(config-if)# encapsulation ppp</p>	<p>Sets the serial interface encapsulation method used by the interface.</p>
Step 6	<pre>ppp multilink</pre> <p>Example: Router(config-if)# ppp multilink</p>	<p>Enables Multilink on an interface.</p>
Step 7	<pre>ppp multilink group group-number</pre> <p>Example: Router(config-if)# ppp multilink group 1</p>	<p>Restricts a physical link to joining only a designated multilink group interface.</p> <ul style="list-style-type: none"> Enter the multilink group number.
Step 8	<pre>end</pre> <p>Example: Router(config-if)# end</p>	<p>(Optional) Exits interface configuration mode.</p>

Verifying the Multilink PPP over Serial Interface Link Configuration

To verify the Multilink PPP over serial interface link configuration, complete the following steps.

SUMMARY STEPS

- enable
- show interfaces [type number] [first] [last] [accounting]
- show ppp multilink [active | inactive | interface bundle-interface | [username name] [endpoint endpoint]]
- show policy-map interface interface-name [vc [vpi/ vci] [dlci dlci] [input | output]
- 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 interfaces [<i>type number</i>] [<i>first</i>] [<i>last</i>] [accounting] Example: Router# show interfaces	(Optional) Displays statistics for all interfaces configured on the router or access server.
Step 3	show ppp multilink [active inactive interface <i>bundle-interface</i> [username <i>name</i>] [endpoint <i>endpoint</i>]] Example: Router# show ppp multilink	(Optional) Displays bundle information for multilink bundles.
Step 4	show policy-map interface <i>interface-name</i> [vc [<i>vpi/</i>] <i>vci</i>] [dlci <i>dlci</i>] [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 permanent virtual circuit (PVC) on the interface.
Step 5	exit Example: Router# exit	(Optional) Exits privileged EXEC mode.

Configuration Examples for Using Multilink PPP over Serial Interface Links

This section contains the following examples:

- [Configuring Multilink PPP over Serial Interface Links on a Multilink Group Interface: Example, page 7](#)
- [Associating the Serial Interface with the Multilink Group: Example, page 8](#)
- [Verifying the Multilink PPP over Serial Interface Link Configuration: Example, page 8](#)

Configuring Multilink PPP over Serial Interface Links on a Multilink Group Interface: Example

The following is an example of configuring Multilink PPP over serial interface 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

```

Associating the Serial Interface with the Multilink Group: Example

The following is an example of associating the serial interface serial4/1 with the multilink group:

```

Router> enable
Router# configure terminal
Router(config)# interface serial 4/1:23
Router(config-if)# no fair-queue
Router(config-if)# encapsulation ppp
Router(config-if)# ppp multilink
Router(config-if)# ppp multilink group 1
Router(config-if)# end

```

Verifying the Multilink PPP over Serial Interface Link Configuration: Example

You can verify the Multilink PPP over serial interface links configuration by using one or more of the following **show** commands:

- **show interfaces**
- **show ppp multilink**
- **show policy-map interface**

The following section provides sample output of the **show ppp multilink** command only. For sample output of the other commands, see the appropriate Cisco IOS Release 12.3 T command reference publication.

show ppp multilink Command Output Example

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

Multilink2, bundle name is 7206-2
Endpoint discriminator is 7206-2
Bundle up for 00:00:09, 1/255 load
Receive buffer limit 12000 bytes, frag timeout 1500 ms
  0/0 fragments/bytes in reassembly list
  0 lost fragments, 0 reordered
  0/0 discarded fragments/bytes, 0 lost received
  0x0 received sequence, 0x3 sent sequence
Member links:1 active, 1 inactive (max not set, min not set)
  Se3/2, since 00:00:10, 240 weight, 232 frag size
  Se3/3 (inactive)

```

Where to Go Next

To use Multilink PPP over ATM links, see the “[Using Multilink PPP over ATM Links](#)” module.

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.

Additional References

The following sections provide references related to Multilink PPP over serial interface 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
Multilink PPP overview module	“Reducing Latency and Jitter for Real-Time Traffic Using Multilink PPP” module
Multilink PPP over ATM links (including ATM interfaces and ATM PVCs)	“Using Multilink PPP over ATM Links” 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

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
<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

Glossary

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, called a permanent virtual connection.

virtual template interface—A logical interface configured with generic configuration information for a specific purpose or 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.

Feature Information for Using Multilink PPP over Serial Interface Links

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For details on when support for specific commands was introduced, see the command reference documents.

For information on a feature in this technology that is not documented here, see the “[Reducing Latency and Jitter Using Multilink PPP Roadmap](#)” module.

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**Note**

Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for Using Multilink PPP over Serial Interface Links

Feature Name	Software Releases	Feature Configuration Information
Distributed Link Fragmentation and Interleaving Over Leased Lines	12.2(8)T	<p>The Distributed Link Fragmentation and Interleaving over Leased Lines feature extends distributed link fragmentation and interleaving functionality to leased lines.</p> <p>This feature was extensively rewritten from the perspective of using Multilink PPP for link fragmentation and interleaving over serial interface links.</p> <p>The following sections provide information about this feature:</p> <ul style="list-style-type: none"> • Information About Using Multilink PPP over Serial Interface Links, page 2 • How to Configure Multilink PPP over Serial Interface Links, page 3
Distributed Link Fragmentation and Interleaving for Frame Relay and ATM Interfaces on Cisco 7500 Series Routers	12.2(4)T	<p>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.</p> <p>This feature was extensively rewritten from the perspective of using Multilink PPP for link fragmentation and interleaving over serial interface links.</p> <p>The following sections provide information about this feature:</p> <ul style="list-style-type: none"> • Information About Using Multilink PPP over Serial Interface Links, page 2 • How to Configure Multilink PPP over Serial Interface Links, page 3

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