



# Multilink PPP Minimum Links Mandatory

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## Feature History

Release	Modification
12.1(11b)E	This feature was introduced.

This document describes the Multilink PPP Minimum Links Mandatory feature in Cisco IOS Release 12.1(11b)E and contains the following sections:

- [Feature Overview, page 1](#)
- [Supported Platforms, page 2](#)
- [Supported Standards, MIBs, and RFCs, page 3](#)
- [Configuration Tasks, page 3](#)
- [Monitoring and Maintaining Multilink PPP Minimum Links Mandatory, page 7](#)
- [Configuration Examples, page 7](#)
- [Command Reference, page 8](#)

## Feature Overview

Multilink PPP allows establishing multiple PPP links in parallel to the same destination. This is often used with dialup lines or ISDN connections to easily increase the amount of bandwidth between points.

With the introduction of the Multilink PPP Minimum Links Mandatory feature, you can configure the minimum number of links in a Multilink PPP (MLP) bundle required to keep that bundle active by entering the **multilink min-links links mandatory** command. When you configure this command, all Network Control Protocols (NCPs) for a MLP bundle are disabled until the MLP bundle has the required minimum number of links. When a new link is added to the MLP bundle that brings the number of links up to the required minimum number of links, the NCPs are activated for the MLP bundle. When a link is removed from an MLP bundle, and the number of links falls below the required minimum number of links for that MLP bundle, the NCPs are disabled for that MLP bundle.

## Benefits

Using this feature you can configure the required number of physical links in an MLP bundle.

## Related Documents

- *Cisco IOS Multiservice Applications Command Reference*, Release 12.1
- *Cisco IOS Multiservice Applications Configuration Guide*, Release 12.1
- *Configuring PPP and Multilink PPP*
- *Configuring Media-Independent PPP and Multilink PPP*
- *Criteria for Naming Multilink PPP Bundles*
- *Troubleshooting Async Multilink PPP Operations*
- *Multichassis Multilink PPP (MMP)*
- *Router-to-Router Async Multilink PPPI*

## Supported Platforms

- Catalyst 5000 family ATM modules
- Catalyst 6000 family ATM modules
- Catalyst 6000 family switches
- Catalyst 8510 switch routers
- Catalyst 8540 switch routers
- Cisco ONS 15000 series routers
- Cisco 7100 series
- Cisco 7200 series
- Cisco 7500 series
- Cisco 7600 Series Internet Router
- LightStream 1010 switch routers

### Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Cisco Feature Navigator. Cisco Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or release. Under the release section, you can compare releases side by side to display both the features unique to each software release and the features in common.

To access Cisco Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to [cco-locksmith@cisco.com](mailto:cco-locksmith@cisco.com). An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions at <http://www.cisco.com/register>.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

#### **Availability of Cisco IOS Software Images**

Platform support for particular Cisco IOS software releases is dependent on the availability of the software images for those platforms. Software images for some platforms may be deferred, delayed, or changed without prior notice. For updated information about platform support and availability of software images for each Cisco IOS software release, refer to the online release notes or Cisco Feature Navigator.

## Supported Standards, MIBs, and RFCs

#### **Standards**

No new or modified standards are supported by this feature.

#### **MIBs**

No new or modified MIBs are supported by this feature.

To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

#### **RFCs**

RFC 1990, *The PPP Multilink Protocol (MP)*

## Configuration Tasks

See the following sections for configuration tasks for the Multilink PPP Minimum Links Mandatory feature. Each task in the list is identified as either required or optional.

- [Configuring PPP, page 4](#) (required)
- [Configuring Multilink PPP, page 5](#) (required)
- [Configuring Multilink PPP Minimum Links Mandatory, page 6](#) (optional)

## Configuring PPP

To configure PPP, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>interface</b> <i>type slot/port</i>	Configures an interface and enters interface configuration mode. <ul style="list-style-type: none"> <li>• <i>type</i>—Type of interface to be configured.</li> <li>• <i>slot</i>—Number of the slot being configured.</li> <li>• <i>port</i>—Number of the port being configured.</li> </ul> <p><b>Note</b> Refer to the appropriate hardware manual for slot and port information.</p>
Step 2	Router(config-if)# <b>encapsulation ppp</b>	Enables PPP encapsulation.
Step 3	Router(config-if)# <b>ppp authentication</b> { <b>chap</b>   <b>chap pap</b>   <b>pap chap</b>   <b>pap</b> } [ <b>if-needed</b> ] [ <i>list-name</i>   <b>default</b> ] [ <b>callin</b> ]	(Optional) Defines the authentication methods supported and the order in which they are used. <ul style="list-style-type: none"> <li>• <b>chap</b>—Enables Challenge Handshake Authentication Protocol (CHAP) on a serial interface.</li> <li>• <b>chap pap</b>—Enables CHAP and Password Authentication Protocol (PAP) on a serial interface and configures CHAP to be used first.</li> <li>• <b>pap chap</b>—Enables CHAP and PAP on a serial interface and configures PAP to be used first.</li> <li>• <b>pap</b>—Enables PAP on a serial interface.</li> <li>• <b>if-needed</b>—(Optional) Used with Terminal Access Controller Access Control System (TACACS) and extended TACACS. Does not perform CHAP or PAP authentication if the user has already provided authentication. This option is available only on asynchronous interfaces.</li> <li>• <i>list-name</i>—(Optional) Used with authentication, authorization, and accounting (AAA). Specifies the name of a list of methods of authentication to use. If no list name is specified, the system uses the default. The list is created with the <b>aaa authentication ppp</b> command.</li> <li>• <b>default</b>—(Optional) The name of the method list is created with the <b>aaa authentication ppp</b> command.</li> <li>• <b>callin</b>—(Optional) Specifies authentication on incoming (received) calls only.</li> </ul>

	Command	Purpose
Step 4	Router(config-if)# <b>exit</b>	Exits interface configuration mode.
Step 5	Router(config)# <b>username</b> <i>name</i> <b>password</b> <i>secret</i>	(Optional) Specifies the password to be used in CHAP or PAP caller identification. <ul style="list-style-type: none"> <li><i>name</i>—Assigns a host name, server name, user ID, or command name. The <i>name</i> argument can be only a single word and not more than one word. Blank spaces and quotation marks are not allowed.</li> <li><i>secret</i>—Specifies the secret for the local router or the remote device. The secret is encrypted when it is stored on the local router. The secret can consist of any string of up to 11 ASCII characters. There is no limit to the number of username and password combinations that can be specified, allowing any number of remote devices to be authenticated.</li> </ul>

## Configuring Multilink PPP

To configure Multilink PPP, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>interface</b> <b>multilink</b> <i>group-number</i>	Creates a multilink bundle and enters multilink interface configuration mode. <ul style="list-style-type: none"> <li><i>group-number</i>—Specifies the number of the multilink bundle. Valid range is 0 to 214748364.</li> </ul>
Step 2	Router(config-if)# <b>ip</b> <b>address</b> <i>address</i>	Assigns an IP address to the interface.
Step 3	Router(config-if)# <b>encapsulation</b> <b>ppp</b>	Enables PPP encapsulation.
Step 4	Router(config-if)# <b>ppp</b> <b>multilink</b>	Enables Multilink PPP.
Step 5	Router(config-if)# <b>multilink</b> <b>max-links</b> <i>links</i>	(Optional) Limits the maximum number of links that Multilink PPP (MLP) can dial for dynamic allocation. <ul style="list-style-type: none"> <li><i>links</i>—Maximum number of links, in the range 0 to 255.</li> </ul>
Step 6	Router(config-if)# <b>multilink</b> <b>min-links</b> <i>links</i>	(Optional) Specifies the preferred minimum number of links in a Multilink PPP (MLP) bundle. <ul style="list-style-type: none"> <li><i>links</i>—Minimum number of links, in the range 0 to 255.</li> </ul>
Step 7	Router(config-if)# <b>bridge-group</b> <i>bridge-group-number</i>	(Optional) Specifies the bridge group to which this interface belongs. Use this command only if bridging is enabled for this interface. <ul style="list-style-type: none"> <li><i>bridge-group-number</i>—Number of the bridge group to which the interface belongs. Valid values are 1 to 255.</li> </ul>
Step 8	Router(config-if)# <b>no</b> <b>shutdown</b>	Enables the interface.

## Configuring Multilink PPP Minimum Links Mandatory

To configure the Multilink PPP Minimum Links Mandatory feature, use the following commands in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# <b>ppp multilink</b>	Enables Multilink PPP.
Step 2	Router(config-if)# <b>multilink min-links</b> <i>links mandatory</i>	Specifies the required minimum number of links in a Multilink PPP (MLP) bundle. If the minimum number of links in the MLP bundle falls below the number specified by the <i>links</i> attribute, the MLP bundle is disabled. <ul style="list-style-type: none"> <li>• <i>links</i>—Minimum number of links, in the range 0 to 255.</li> </ul>

## Verifying Multilink PPP Down Support

Use the **show running-configuration** command to verify configuration of the Multilink PPP Minimum Links Mandatory feature:

```
Router# show running-configuration
.
.
.
interface multilink1
 ip address 10.1.1.1 255.255.255.0
  ppp encapsulation
  ppp authentication chap
  ppp multilink
  multilink max-links 100
  multilink min-links 10 mandatory

interface BRI2/1
 no ip address
 encapsulation ppp
 dialer pool-member 2
 no fair-queue
 no cdp enable
 ppp authentication chap
 ppp multilink

interface bri 0
 description connected to abc 81012345678902
 ip address 171.1.1.7 255.255.255.0
 encapsulation ppp
 dialer idle-timeout 30
 dialer map ip 172.16.0.0 name cisco 81012345678901
 dialer-group 1
 ppp authentication pap
 ppp multilink
 multilink min-links 2 mandatory
```

# Monitoring and Maintaining Multilink PPP Minimum Links Mandatory

To monitor and maintain Multilink PPP Minimum Links Mandatory, use the following EXEC commands:

Command	Purpose
Router# <code>show interfaces multilink group-number</code>	Displays statistics for the specified multilink bundle.
Router# <code>show ppp multilink</code>	Displays information about all existing multilink bundles and their member links.
Router# <code>show interfaces multilink group-number stat</code>	Displays traffic statistics for a multilink bundle.

## Configuration Examples

This section provides the following configuration examples:

- [Configuring PPP Example, page 7](#)
- [Configuring Multilink PPP Example, page 7](#)
- [Configuring Multilink PPP Minimum Links Mandatory Example, page 8](#)

## Configuring PPP Example

The following example shows how to configure PPP on a serial interface with CHAP authentication:

```
interface serial 1/0
 encapsulation ppp
 authentication chap
 exit
 username abc password password1
```

## Configuring Multilink PPP Example

The following example shows how to configure Multilink PPP. In this example, the MLP bundle is configured with CHAP authentication. The minimum number of links for this MLP bundle is 5 and the maximum number of links is 100.

```
interface multilink 3
 ip address 172.16.0.0
 encapsulation ppp
 ppp multilink
 ppp authentication chap
 ppp chap hostname name
 multilink min-links 5
 multilink max-links 100
 bridge-group 2
 no shutdown
```

## Configuring Multilink PPP Minimum Links Mandatory Example

The following example shows how to configure a MLP bundle to be required to have at least five active sessions:

```
ppp multilink
multilink min-links 5 mandatory
```

## Command Reference

This section documents the following modified command. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- [multilink min-links](#)

## multilink min-links

To specify the preferred minimum number of links in a Multilink PPP (MLP) bundle, use the **multilink min-links** command in interface configuration mode. To reset the default value, use the **no** form of this command.

**multilink min-links** *links* [**mandatory**]

**no multilink min-links** *links* [**mandatory**]

### Syntax Description

<i>links</i>	Minimum number of links, in the range 0 to 255.
<b>mandatory</b>	(Optional) If the minimum number of links is not present, the MLP bundle is deactivated.

### Defaults

The minimum number of links is 0.

### Command Modes

Interface configuration

### Command History

Release	Modification
11.3	This command was introduced.
12.1(11b)E	The optional <b>mandatory</b> keyword was introduced.

### Usage Guidelines

If a bundle contains fewer links and there is a means to establish additional channels (for example, available dialer channels), then MLP attempts to increase the number of links up to this limit.

If the **dialer max-links** command is configured, MLP will not exceed its value even if the **ppp multilink max-link** command is a higher value. This restriction does not affect the number of links you can configure, but rather what happens at run time.

The value set in the **multilink min-links** command specifies the minimum number of links that MLP will try to keep in a bundle. MLP attempts to dial up additional links to obtain the number specified by the links argument, even if the load does not exceed the load threshold.

If you configure the optional **mandatory** keyword, the MLP bundle is disabled if the specified minimum number of links is not available.

### Examples

The following example shows how to set the minimum number of links to 12:

```
multilink min-links 12
```

The following example shows how to set a mandatory minimum number of links to 5:

```
multilink min-links 5 mandatory
```

■ **multilink min-links**

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>multilink max-links</b>	Limits the maximum number of links that MLP can dial for dynamic allocation.