# multilink

To limit the total number multilink PPP (MLP) sessions for all virtual private dialup network (VPDN) multilink users, enter the **multilink** command in VPDN group configuration mode. To remove the MLP session limit, enter the **no** form of this command.

**multilink** {**bundle** *bundles* | **link** *links*}

**no multilink** {**bundle** *bundles* | **link** *links*}

## Syntax Description

| | |
|---|---|
| **bundle** *bundles* | Configures the number of MLP bundles supported for a VPDN group. In general, each user requires one bundle. Valid values for the *bundles* argument range from 0 to 32,767. |
| **link** *links* | Configures the number of sessions supported for each bundle. Valid values for the links argument range from 0 to 32,767. |

## Command Default

No MLP session limit is set.

## Command Modes

VPDN group configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(4)XI | This command was introduced. |
| 12.0(5)T | This command was integrated into Cisco IOS Release 12.0(5)T. |

## Usage Guidelines

Use the **multilink** VPDN group configuration command to limit the total number of sessions for all MLP users. Each user requires one bundle, regardless if the user is a remote modem client or an ISDN client.

One modem client using one B channel requires one link. One ISDN BRI node may require up to two links for one BRI line connection. The second B channel of an ISDN BRI node comes up when the maximum threshold is exceeded.

## Examples

The following example configures a VPDN group called group1 to initiate Layer 2 Tunnel Protocol (L2TP) tunnels to the tunnel server at IP address 10.2.2.2. Ten MLP bundles are configured for users that dial in to the domain cisco.com. Each bundle is configured to support a maximum of 5 links, limiting the total number of MLP sessions to 50.

```
Router(config)# vpdn-group group1
Router(config-vpdn)# request-dialin
Router(config-vpdn-req-in)# protocol l2tp
Router(config-vpdn-req-in)# domain cisco.com
Router(config-vpdn-req-in)# exit
Router(config-vpdn)# initiate-to ip 10.2.2.2
Router(config-vpdn)# multilink bundle 10
Router(config-vpdn)# multilink link 5
```

**Related Commands**

| Command | Description |
|---|---|
| **request-dialin** | Creates a request dial-in VPDN subgroup that configures a NAS to request the establishment of a dial-in tunnel to a tunnel server, and enters request dial-in VPDN subgroup configuration mode. |
| **vpdn-group** | Creates a VPDN group and enters VPDN group configuration mode. |

# multilink bundle-name

To select a method for naming multilink bundles, use the **multilink bundle-name** command in global configuration mode. To remove the selection method, use the **no** form of this command.

**multilink bundle-name** {**authenticated** | **endpoint** | **both**}

**no multilink bundle-name** {**authenticated** | **endpoint** | **both**}

## Syntax Description

| | |
|---|---|
| **authenticated** | Authenticated name of the peer. This is the default. |
| **endpoint** | Endpoint discriminator of the peer. |
| **both** | Authenticated name and endpoint discriminator of the peer. |

## Defaults

Authenticated name of the peer.

## Command Modes

Global configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

The **authenticated** keyword defines the selection criteria for the bundle name as the authenticated name, the endpoint discriminator if the link is not authenticated, or the caller ID if neither an authenticated name nor an endpoint is supplied.

The **endpoint** keyword defines the selection criteria for the bundle name as the endpoint discriminator, the authenticated name if no endpoint is supplied, or the caller ID if neither an authenticated name nor an endpoint is supplied.

The **both** keyword defines the selection criteria for the bundle name as an authenticated name-endpoint discriminator pair, the authenticated name if no endpoint is supplied, the endpoint discriminator if the link is not authenticated, or the caller ID if neither an authenticated name nor an endpoint is supplied.

## Examples

The following example sets the selection criteria for the multilink bundle name as the endpoint discriminator:

```
multilink bundle-name endpoint
```

# multilink-group

The **multilink-group** command is replaced by the **ppp multilink group** command. See the description of the **ppp multilink group** command for more information.

**Note** The command is still recognized and accepted by the Cisco IOS software. The **show running-config** and **write memory** commands will display and generate the original command in Cisco IOS Release 12.2.

# multilink max-fragments

The **multilink max-fragments** command is replaced by the **ppp multilink fragment maximum** command. See the description of the **ppp multilink fragment maximum** command for more information.

# multilink virtual-template

To specify a virtual template from which the specified Multilink PPP (MLP) bundle interface can clone its interface parameters, use the **multilink virtual-template** command in global configuration mode. To remove the defined virtual template, use the **no** form of the command.

**multilink virtual-template** *number*

**no multilink virtual-template** *number*

## Syntax Description

| | |
|---|---|
| *number* | Number of virtual templates. An integer in the range from 1 to the largest number of virtual templates the software image supports (typically 25). |

## Defaults

No template number is defined.

## Command Modes

Global configuration

## Command History

| Release | Modification |
|---|---|
| 11.2 | This command was introduced. |

## Usage Guidelines

Configuring a specific IP address in a virtual template can result in the establishment of erroneous routes and the loss of IP packets.

## Examples

The following example specifies an MLP virtual template to be used and then defines the template to be applied to an MLP bundle interface:

```
multilink virtual-template 1
interface virtual-template 1
 ip unnumbered ethernet 0
 encapsulation ppp
 ppp multilink
 ppp authentication chap
```

## Related Commands

| Command | Description |
|---|---|
| **interface virtual-template** | Creates a virtual template interface that can be configured and applied dynamically in creating virtual access interfaces. |

# name (dial peer cor custom)

To specify the name for a custom class of restrictions (COR), use the **name** command in dial peer COR custom configuration mode. To remove a specified COR, use the **no** form of this command.

**name** *class-name*

**no name** *class-name*

## Syntax Description

| | |
|---|---|
| *class-name* | Name that describes the specific COR. |

## Defaults

No default behavior or values.

## Command Modes

Dial peer COR custom configuration

## Command History

| Release | Modification |
|---|---|
| 12.1(3)T | This command was introduced. |

## Usage Guidelines

The **dial-peer cor custom** and **name** commands define the names of capabilities on which to apply COR operation. Examples of names might include any of the following: call1900, call527, call9, or call 911. You must define the capabilities before you specify the COR rules.

You can define a maximum of 64 COR names.

## Examples

The following example defines three COR names:

```
dial-peer cor custom
 name 900_call
 name 800_call
 name catchall
```

## Related Commands

| Command | Description |
|---|---|
| **dial-peer cor custom** | Specifies that named CORs apply to dial peers. |

# netbios nbf

To enable the NetBIOS Frames Protocol (NBF) on an interface, use the **netbios nbf** command in interface configuration mode. To disable NetBIOS Frames Protocol support on an interface, use the **no** form of this command.

**netbios nbf**

**no netbios nbf**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.1 | This command was introduced. |

## Examples

The following example enables NBF on asynchronous interface 1 (connected to remote access client using a NetBEUI application) and Ethernet interface 0 (connected to the remote router):

```
interface async 1
 netbios nbf
interface ethernet 0
 netbios nbf
```

## Related Commands

| Command | Description |
|---|---|
| **netbios name-cache** | Defines a static NetBIOS name cache entry, tying the server with the name netbios-name to the mac-address, and specifying that the server is accessible either locally through the interface-name specified, or remotely through the ring-group group-number specified. |
| **show nbf sessions** | Displays NetBEUI connection information. |
| **show netbios cache** | Displays a list of NetBIOS cache entries. |

# network-clock-priority

To specify the clock-recovery priority for the BRI voice ports in a BRI voice module (BVM), use the **network-clock-priority** command in interface configuration mode. To restore the default (low) clock-recovery priority, use the **no** form of this command.

**network-clock-priority** {**low** | **high**}

**no network-clock-priority** {**low** | **high**}

## Syntax Description

| | |
|---|---|
| **low** | The BRI port is second priority to recover clock. |
| **high** | The BRI port is first priority to recover clock. |

## Defaults

Each BRI voice port has low clock-recovery priority. The BRI VIC port provides clocking (high).

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(3)XG | This command was introduced on the Cisco MC3810 concentrator. |
| 12.1(3)XI | This command was implemented on the Cisco 2600 series and Cisco 3600 series. |

## Usage Guidelines

Because the BRI VIC can support both NT and TE ports, this command allows a "local loop" to be configured for testing. By default the TE port on the BRI VIC receives the clock source to drive the whole BRI (**network-clock-priority high**). Setting the clock priority to **low** allows the connected port to provide clocking.

This command becomes effective only when the BVM is the clock source for the Cisco MC3810, which can happen in one of three ways:

- When the BVM is specified as the first-priority network clock source through the **network-clock-select** command.
- When the BVM is specified as a lower-priority network clock source, and a higher-priority network clock source is lost.
- When the BVM is the only network clock source.

The BRI voice port supplying clock operates as a line source; if there are other BRI voice ports configured as TE, they operate in loop-timed mode.

Regardless of the **network-clock-priority** setting, the first TE-configured BRI voice port that becomes active is automatically chosen to supply clock. The clock source does not change if another BRI voice port configured for **network-clock-priority high** becomes active.

If the chosen clocking port becomes inactive, the system searches for clock on the active TE-configured ports in the following order:

1. Ports configured as **network-clock-priority high** in order from lowest (1) to highest (4).
2. Ports configured as **network-clock-priority low** in order from lowest (1) to highest (4).

If the originally chosen port then reactivates, it resumes its role as clock source regardless of its **network-clock-priority** setting.

If you enter either the **no network-clock-priority low** or the **no network-clock-priority high** command, the network clock priority defaults to low.

## Examples

The following example configures BRI voice port 1 as a first priority clock source:

```
interface bri 0/1
 network-clock-priority high
```

## Related Commands

| Command | Description |
|---|---|
| **network-clock-select** | Specifies selection priority for the clock sources. |

# number

To add a Calling Line Identification (CLID) or Dialed Number Identification Service (DNIS) number to a dialer group, use the **number** command in CLID group configuration or DNIS group configuration mode followed by the specifying number. To remove a number from a group, use the **no** form of this command.

**number** *ID-number*

**no number** *ID-number*

## Syntax Description

| | |
|---|---|
| *ID-number* | CLID or DNIS number, which can have up to 65 digits. |

**Note** The CLID screening feature rejects this number if it matches the CLID of an incoming call. Valid CLID numbers are all numeric, or numbers that contain the wildcard *x*. You can use *x* (signifying a single number don't care state), *X* or **.** as wildcards within each CLID number. The asterisk (*) wildcard is not accepted.

## Defaults

No default behavior or values.

## Command Modes

CLID group configuration
DNIS group configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(4)XI | This command was introduced. |
| 12.1(5)T | This command was enhanced to add CLID numbers to a CLID group and DNIS numbers to a DNIS group. |

## Usage Guidelines

You can organize CLID numbers for a customer or service type into a CLID group. You can add multiple CLID groups to a customer profile. Add all CLID numbers into one CLID group, or subdivide the CLID numbers using criteria such as call type, geographical location, or division.

The Cisco IOS software also includes a feature that streamlines the DNIS configuration process. By replacing any digit with an *X* (for example, issuing the **number 555222121*x*** command), clients dialing different numbers, such as 5552221214 or 5552221215, are automatically mapped to the same customer profile. The *X* variable is a placeholder for the digits 1 through 9.

## Examples

The following example shows the command to use to assign a number to a CLID group named "zot":

```
dialer clid group zot
 number 2121212121
```

The following example shows a DNIS group called dnis_isp_1 and DNIS numbers 1234 and 5678 assigned to the DNIS group:

```
dialer dnis group dnis_isp_1
 number 1234
 number 5678
```

## Related Commands

| Command | Description |
|---|---|
| **clid group** | Adds a CLID group to a discriminator. |
| **dnis group** | Includes a group of DNIS numbers in a customer profile. |
| **resource-pool call treatment discriminator** | Creates a call discrimination profile. |

# peer default ip address

To specify an IP address, an address from a specific IP address pool, or an address from the Dynamic Host Configuration Protocol (DHCP) mechanism to be returned to a remote peer connecting to this interface, use the **peer default ip address** command in interface configuration mode. To disable a prior peer IP address pooling configuration on an interface, or to remove the default address from your configuration, use the **no** form of this command.

**peer default ip address** {*ip-address* | **dhcp** | **pool** [*pool-name-list*]}

**no peer default ip address**

## Syntax Description

| | |
|---|---|
| *ip-address* | Specific IP address to be assigned to a remote peer dialing in to the interface. To prevent duplicate IP addresses from being assigned on more than one interface, this argument cannot be applied to a dialer rotary group nor to an ISDN interface. |
| **dhcp** | Retrieves an IP address from the DHCP server. |
| **pool** | Uses the global default mechanism as defined by the **ip address-pool** command unless the optional *pool-name-list* argument is supplied. This is the default. |
| *pool-name-list* | (Optional) Name of one or more local address pools created using the **ip local pool** command. Software retrieves an address from this pool regardless of the global default mechanism set. |

## Defaults

The default is **pool**.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.0 | This command was introduced. |

## Usage Guidelines

This command applies to point-to-point interfaces that support the PPP or Serial Line Internet Protocol (SLIP) encapsulation. This command sets the address used on the remote (PC) side.

**Note** This command replaces the **async default ip address** command.

This command allows an administrator to configure all possible address pooling mechanisms on an interface-by-interface basis.

The **peer default ip address** command can override the global default mechanism defined by the **ip address-pool** command on an interface-by-interface basis, as follows:

- For all interfaces not configured with a peer default IP address mechanism (equivalent to selecting the **peer default ip address pool** command), the router uses the global default mechanism that is defined by the **ip address-pool** command.

- If you select the **peer default ip address pool** *pool-name-list* form of this command, then the router uses the locally configured pool on this interface and does not follow the global default mechanism.
- If you select the **peer default ip address** *ip-address* form of this command, the specified IP address is assigned to any peer connecting to this interface and any global default mechanism is overridden for this interface.
- If you select the **peer default ip address dhcp** form of this command, the DHCP proxy-client mechanism is used by default on this interface and any global default mechanism is overridden for this interface.

## Examples

The following command specifies that this interface will use a local IP address pool named pool3:

```
peer default ip address pool pool3
```

The following command specifies that this interface will use the IP address 172.19.34.21:

```
peer default ip address 172.19.34.21
```

The following command reenables the global default mechanism to be used on this interface:

```
peer default ip address pool
```

The following example specifies address 192.168.7.51 for asynchronous interface 6:

```
line 20
 speed 115200
interface async 6
 peer default ip address 192.168.7.51
```

## Related Commands

| Command | Description |
|---|---|
| **async dynamic address** | Specifies dynamic asynchronous addressing versus default addressing. |
| **encapsulation slip** | Enables SLIP encapsulation. |
| **exec** | Allows an EXEC process on a line. |
| **ip address-pool** | Enables an address pooling mechanism used to supply IP addresses to dial in asynchronous, synchronous, or ISDN point-to-point interfaces. |
| **ip dhcp-server** | Specifies which DHCP servers to use on a network, and specifies the IP address of one or more DHCP servers available on the network. |
| **ip local pool** | Configures a local pool of IP addresses to be used when a remote peer connects to a point-to-point interface. |
| **ppp** | Starts an asynchronous connection using PPP. |
| **show cot dsp** | Displays the current DHCP settings on point-to-point interfaces. |
| **slip** | Starts a serial connection to a remote host using SLIP. |

# peer match aaa-pools

To specify that any IP address pool name supplied by authentication, authorization, and accounting (AAA) servers must also be present in the list of pool names specified in the **peer default ip address pool** interface configuration command, use the **peer match aaa-pools** command in interface configuration mode. To configure the software to use any pool name supplied by the AAA server (default configuration), use the **no** form of this command.

**peer match aaa-pools**

**no peer match aaa-pools**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)T | This command was introduced. |

## Usage Guidelines

This command provides the ability to control or restrict the use of pool names supplied by AAA to only those pool names that are configured on the router. This ability is useful in cases where the AAA server and the router and its local configuration are controlled by different administrators, as would be the case for a wholesale dial supplier where the AAA servers are owned by individual customers.

When the **peer match aaa-pools** command is configured on an interface, the IP address pool names used are those specified in the local configuration as part of the **peer default ip address** command and the pool names supplied by the AAA server.

When the **no peer match aaa-pools** command is used, pool name selection is controlled by the AAA server, as follows: When the AAA server supplies a pool name, that is the only pool used. If AAA does not supply a pool name, then the normal IP default pool name processing is used as described in the **peer default ip address** command page.

## Examples

The following example shows how to configure pool name restrictions in a Resource Pool Management (RPM) customer profile template:

```
template Word
  multilink max-fragments
  peer match aaa-pools
  peer default ip address pool poolA poolB
  ppp ipcp dns 10.1.1.1
resource-pool profile customer WORD
  source template Word
  aaa group-configuration AAA-group1
```

```
template acme_direct
  peer default ip address pool tahoe
  ppp authentication chap isdn-users
  ppp multilink
```

## Related Commands

| Command | Description |
|---|---|
| **ip local pool** | Configures a local pool of IP addresses to be used when a remote peer connects to a point-to-point interface. |
| **peer default ip address** | Specifies an IP address, an address from a specific IP address pool, or an address from the DHCP mechanism to be returned to a remote peer connecting to this interface. |
| **peer pool backup** | Directs the pool software to use the local pool name configured with the **peer default ip address** interface configuration command to supplement the pool names supplied by AAA. |
| **peer pool static** | Suppresses an attempt to load all dynamic pools from the AAA server when a missing pool name is encountered. |

# permission (dial peer voice)

To specify whether incoming or outgoing calls are permitted on the defined dial peer, use the **permission** command in dial peer voice configuration mode. To remove the specified permission, use the **no** form of this command.

**permission** {**orig** | **term** | **both** | **none**}

**no permission** {**orig** | **term** | **both** | **none**}

## Syntax Description

| | |
|---|---|
| **orig** | This dial peer is permitted to originate calls. Thus, the access server can accept incoming calls from the dial peer. |
| **term** | This dial peer is permitted to terminate calls. Thus, the access server can send outgoing calls to the dial peer. |
| **both** | This dial peer is permitted to originate and terminate calls. Both incoming and outgoing calls are permitted (default). |
| **none** | No incoming or outgoing calls can be made to or from this dial peer. |

## Defaults

Both incoming and outgoing calls are permitted.

## Command Modes

Dial peer voice configuration

## Command History

| Release | Modification |
|---|---|
| 12.1(3)T | This command was introduced. |

## Usage Guidelines

After a dial peer is associated with an incoming call, the permission is checked to determine whether incoming calls are permitted on the dial peer. If permission is not set to **orig** or **both**, the incoming call is blocked.

After a dial peer is matched for an outgoing call, the permission is checked to determine whether outgoing calls are permitted on the dial peer. If permission is not set to **term** or **both**, the outgoing call using this dial peer fails.

**Note** The call may "rotary" to the next dial peer if the current dial peer does not have the **huntstop** command set.

## Examples

The following example configures a dial peer and sets its permission to both originate and terminate calls:

```
dial-peer voice 526 pots
 answer-address 408526....
 corlist incoming list2
 direct-inward-dial
 permission both
```

## Related Commands

| Command | Description |
|---|---|
| **dial-peer voice** | Enters dial-peer voice configuration mode and defines a remote VoIP dial peer. |

# pool-member

To assign a request-dialout virtual private dialup network (VPDN) subgroup to a dialer pool, use the **pool-member** command in VPDN request-dialout configuration mode. To remove the request-dialout VPDN subgroup from a dialer pool, use the **no** form of this command.

**pool-member** *pool-number*

**no pool-member** [*pool-number*]

## Syntax Description

| | |
|---|---|
| *pool-number* | Dialer pool to which this VPDN group belongs. |

## Defaults

Command is disabled.

## Command Modes

VPDN request-dialout configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(5)T | This command was introduced. |

## Usage Guidelines

Before you can enable the **pool-member** command, you must first enable the **protocol l2tp** command on the request-dialout VPDN subgroup. Removing the **protocol l2tp** command will remove the **pool-member** command from the request-dialout VPDN subgroup.

You can only configure one dialer profile pool (using the **pool-member** command) or dialer rotary group (using the **rotary-group** command). If you attempt to configure a second dialer resource, you will replace the first dialer resource in the configuration.

## Examples

The following example configures VPDN group 1 to request L2TP dial-out to IP address 172.16.4.6 using dialer profile pool 1 and identifying itself using the local name "user1."

```
vpdn-group 1
 request-dialout
  protocol l2tp
  pool-member 1
 initiate-to ip 172.16.4.6
 local name user1
```

## Related Commands

| Command | Description |
|---|---|
| **initiate-to** | Specifies the IP address that will be tunneled to. |
| **protocol (VPDN)** | Specifies the Layer 2 tunneling protocol that the VPDN subgroup will use. |
| **request-dialout** | Enables an LNS to request VPDN dial-out calls by using L2TP. |
| **rotary-group** | Assigns a request-dialout VPDN subgroup to a dialer rotary group. |

# pool-range

To assign a range of modems to a modem pool, use the **pool-range** command in modem-pool configuration mode. To remove the range of modems, use the **no** form of the command.

**pool-range** [**tty**] {*modem1*-*modemN* | *x*/*y*}

**no pool-range** [**tty**] {*modem1*-*modemN* | *x*/*y*}

## Syntax Description

| | |
|---|---|
| **tty** | (Optional) Sets the range to terminal controller (TTY) lines. |
| *modem1*-*modemN* | Range of lines, which correspond to a range of modems or to a modem pool. A hyphen (-) is required between the two numbers. The range of modems you can choose from is equivalent to the number of modems in your access server that are not currently associated with another modem pool, up to a maximum of 48. |
| *x*/*y* | Slot/port numbers for an internal modem. A range of numbers is not accepted. The slash mark is required. |

## Defaults

Command is disabled. All modems are configured to be part of the system default modem pool.

## Command Modes

Modem pool configuration

## Command History

| Release | Modification |
|---|---|
| 11.2 P | This command was introduced on the Cisco AS5200 and Cisco AS5300. |

## Usage Guidelines

For a complete description of modem pools and how they are configured on Cisco access servers, see the command page for the **modem-pool** command.

Replace the*modem1*-*modemN* arguments with the modem TTY line numbers that correspond with the range of modems you want in the modem pool. TTY line numbers start from 1, and they map to modem numbers that start from 0. For example, if you want to include modems 1/0 through 1/23 in a pool range, use the TTY line numbers 1 to 24. To verify the modem to TTY line numbering scheme, use the **show modem** *slot*/*port* command.

**Note** MICA technologies modems and Microcom modems support incoming analog calls over ISDN PRI. However, only MICA modems support modem pooling for CT1 and CE1 configurations with channel–associated signaling.

## Examples

The following example assigns modem TTY line numbers 30 to 50 to a modem pool. The Dialed Number Information Service (DNIS) number is set to 2000. The customers dialing 2000 are guaranteed access to 21 modems. The 22nd client to dial in is refused connectivity because the maximum number of allowable connections is exceeded.

```
modem-pool v90service
 pool-range 30-50
 called-number 2000 max-conn 21
 exit
```

The following configuration rejects the **pool-range 30** command, because modem TTY line 30 is already a member of the modem pool v90service, which was configured in the previous example. Each modem in the access server is automatically assigned to a unique TTY line. TTY line numbers are assigned according to your shelf, slot, or port hardware configuration.

```
modem-pool v34service
 pool-range tty 30

% TTY 30 is already in another pool.
```

## Related Commands

| Command | Description |
|---|---|
| **called-number (modem pool)** | Assigns a called party number to a pool of modems. |
| **clear modempool-counters** | Clears active or running counters associated with one or more modem pools. |
| **modem-pool** | Creates a new modem pool or specifies an existing modem pool, which allows you to physically or virtually partition your access server for dial-in and dial-out access. |
| **show modem-pool** | Displays the configuration and connection status for one or more modem pools. |

# port (global)

To enter the port configuration mode, use the port command in global configuration mode. To exit port configuration mode, use the **no** form of this command.

**Cisco AS5400 with NextPort DFC**

**port** {*slot* | *slot*/*port*}

**no port** {*slot* | *slot*/*port*}

**Cisco AS5800 with Universal Port Card**

**port** {*shelf*/*slot* | *shelf*/*slot*/*port*}

**no port** {*shelf*/*slot* | *shelf*/*slot*/*port*}

## Syntax Description

| | |
|---|---|
| *slot* | All ports on the specified slot. For the Cisco AS5400, slot values range from 0 to 7. The slash mark is required. |
| *slot*/*port* | All ports on the specified slot and SPE. For the Cisco AS5400, slot values range from 0 to 7 and port values range from 0 to 107. The slash mark is required. |
| *shelf*/*slot* | All ports on the specified shelf and slot. For the Cisco AS5800, shelf values are 0 and 1, and UPC slot values range from 2 to 11. The slash mark is required. |
| *shelf*/*slot*/*port* | All ports on the specified SPE. For the Cisco AS5800, shelf values are 0 and 1, slot values range from 2 to 11, and port values range from 0 to 323. The slash mark is required. |

## Defaults

Command is disabled.

## Command Modes

Global configuration

## Command History

| Release | Modification |
|---|---|
| 12.1(3)T | This command was introduced. |

## Usage Guidelines

The **port** command helps you to enter the port configuration mode. The port configuration mode allows you to shut down or put individual ports or ranges of ports in busyout mode.

## Examples

The following example shows how to enter port configuration mode on ports 1 to 18 to perform further tasks on the ports:

```
Router(config)# port 1/1 1/18
Router(config-port)# shutdown
```

## Related Commands

| Command | Description |
|---|---|
| **clear port** | Resets the port and clears any active calls to the port. |

# port modem autotest

To automatically and periodically perform a modem diagnostics test for modems inside the access server or router, use the **port modem autotest** command in global configuration mode. To disable or turn off the modem autotest service, use the **no** form of this command.

**port modem autotest** {**error** *threshold* | **minimum** *modems* | **time** *hh*:*mm* [*interval*]}

**no port modem autotest**

## Syntax Description

| | |
|---|---|
| **error** *threshold* | Maximum modem error threshold. When the system detects this many errors with the modems, the modem diagnostics test is automatically triggered. Specify a threshold count from 3 to 50. |
| **minimum** *modems* | Minimum number of modems that will remain untested and available to accept calls during each test cycle. You can specify from 5 to 48 modems. The default is 6 modems on the Cisco AS5400. The range for the Cisco AS5800 is from 73 to 756. |
| **time** *hh*:*mm* | Time you want the modem autotest to begin. You must use the military time convention and a required colon (:) between the hours and minutes variables for this feature. For example, 1:30 p.m. is issued as 13:30. |
| *interval* | (Optional) Long-range time variable used to set the modem autotest more than one day in advance. The range of hours is from 1 hour to 168 hours. For example, if you want to run the test once per week, issue 168. There are 168 hours in one week. |

## Defaults

Modem diagnostics tests are disabled.

## Command Modes

Global configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |
| 12.1(1)XD | This command was introduced on the Cisco AS5400 as the **port modem autotest** command and replaced the **modem autotest** command for the NextPort dial feature card (DFC) only. |
| 12.1(3)T | This command was implemented on the Cisco AS5400 and Cisco AS5800. |

## Examples

The following example shows how to set the modem autotest to run once per week at 3:00 a.m. Additionally, the autotest activates if the system detects a modem error count higher than 40 errors.

Determine the current time set on the access server with the **show clock** EXEC command. In this example, the time and date set is 3:00 p.m, Monday, August 25, 1997:

```
Router# show clock
*15:00:01.031 EST Aug 25 1997
```

Enter global configuration mode and set the time you want the modem autotest to activate. In this example, the access server is configured to run the modem autotest at 3:00 a.m. and every 168 hours (week) thereafter:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# port modem autotest time 03:00 168
```

Configure the autotest to activate if the system detects a high modem error count. In this example, the autotest activates if the system detects a modem error count higher than 40 errors. For the list of modem errors that are monitored by the **modem autotest** command, see the **show modem call-stats** command.

```
Router(config)# port modem autotest error 40
```

## Related Commands

| Command | Description |
|---|---|
| **show clock** | Displays the system clock. |
| **show modem** | Displays a high-level performance report for all the modems or a single modem inside Cisco AS5200 and Cisco AS5300 access servers. |
| **show modem test** | Displays the modem test log. |

# ppp

To start an asynchronous connection using PPP, use the **ppp** command in EXEC mode.

**ppp** {**/default** | {*remote-ip-address* | *remote-name*} [@*tacacs-server*]} [**/routing**] **negotiate**

## Syntax Description

| | |
|---|---|
| **/default** | Makes a PPP connection when a default address has been configured. |
| *remote-ip-address* | IP address of the client workstation or PC. This parameter can be specified only if the line is set for dynamic addresses using the **async address dynamic** line configuration command. |
| *remote-name* | Name of the client workstation or PC. This parameter can be specified if the line is set for dynamic addresses using the **async address dynamic** line configuration command. |
| @*tacacs-server* | (Optional) IP address or IP host name of the TACACS server to which the user's TACACS authentication request is sent. The at sign is required. |
| **/routing** | (Optional) Indicates that the remote system is a router and that routing messages should be exchanged over the link. The line must be configured for asynchronous routing using PPP encapsulation. |
| **negotiate** | Use PPP negotiated IP address. |

## Command Modes

EXEC

## Command History

| Release | Modification |
|---|---|
| 10.0 | This command was introduced. |

## Usage Guidelines

When you connect from a remote node computer to an EXEC session on the access server and want to connect from the access server to a device on the network, issue the **ppp** command.

If you specify an address for the TACACS server (either **/default** or @*tacacs-server*), the address must be the first parameter in the command after you type **ppp**. If you do not specify an address or enter the **default** keyword, you are prompted for an IP address or host name. You can enter the **default** keyword at this point.

To terminate a session, disconnect from the device on the network using the command specific to that device. Then, exit from the EXEC by using the **exit** command.

## Examples

The following example shows a line that is in asynchronous mode using PPP encapsulation. The name of the computer (ntpc in this example) must be in the Domain Name System (DNS) so that it can be resolved to a real IP address). The computer must be running a terminal emulator program.

```
Router# ppp ntpc@server1
```

# ppp accm

To specify the Asynchronous Control Character Map (ACCM) sent to a peer in PPP outbound requests, use the **ppp accm** command in interface configuration mode. To restore the default state, use the **no** form of this command.

**ppp accm** *hex-number*

**no ppp accm**

## Syntax Description

| | |
|---|---|
| *hex-number* | Specifies the initial value for the ACCM. The value must be a hexadecimal number in the range from 0x0 to 0xffffffff, where the bit positions from right to left correspond to the characters 0x00 through 0x1F. The default character map (0xA0000) escapes the characters represented by 0x11 (^Q, DC1, and X-on) and 0x13 (^S, DC3, and X-off). |

**Note** The leading 0x is not necessary when entering the *hex-number* argument, but is accepted by the software.

## Defaults

The default ACCM is 0xA0000.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.2 | This command was introduced. |

## Usage Guidelines

The **ppp accm** command specifies the control character mapping table sent to a peer in a PPP outbound Config-Request packet, to inform the peer which characters need to be escaped when transmitting data containing control characters. The escaped characters set by the **ppp accm** command are useful for allowing data to pass uninterpreted through a network that would normally interpret the control sequences as a command.

For example, the ^Q and ^S characters are software flow control commands used by asynchronous modems to start and stop data transmissions. To allow these characters to be sent as part of a data stream and not be interpreted as control codes by intervening devices, the characters must be escaped, and the **ppp accm** command specifies which characters to use.

The **ppp accm** command is meaningful only on asynchronous interfaces. If entered on other interface types, it will be ignored.

## Examples

In the following example, all characters can be transmitted intact to the receiver so that it is not necessary for the transmitter to escape anything:

```
interface async 0
 encapsulation ppp
 ppp accm 0
```

# ppp bap call

To set PPP Bandwidth Allocation Protocol (BAP) call parameters, use the **ppp bap call** command in interface configuration mode. To disable processing of a specific type of incoming connection, use the **no** form of this command.

**ppp bap call** {**accept** | **request** | **timer** *seconds*}

**no ppp bap call** {**accept** | **request** | **timer**}

## Syntax Description

| | |
|---|---|
| **accept** | Peer initiates link addition. This is the default. |
| **request** | Local side initiates link addition. |
| **timer** *seconds* | Number of seconds to wait between call requests the router sends, in the range from 2 to 120 seconds. No default value is set. |

## Defaults

Peers can initiate the addition of links to a multilink bundle; the timer is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

This command can be included in a virtual interface template for configuring virtual interfaces or can be used to configure a dialer interface.

## Examples

The following example configures a dialer interface to accept calls. Accepting calls is the default, but the command is included for the sake of the example.

```
interface dialer 1
 ip unnumbered ethernet 0
 encapsulation ppp
 ppp multilink bap
 ppp bap call accept
 ppp bap link types isdn analog
 dialer load threshold 30
 ppp bap timeout pending 60
```

## Related Commands

| Command | Description |
|---|---|
| **ppp bap callback** | Enables PPP BAP callback and set callback parameters. |
| **ppp bap drop** | Sets parameters for removing links from a multilink bundle. |
| **ppp bap link types** | Specifies the types of links that can be included in a specific multilink bundle. |

# ppp bap callback

To enable PPP Bandwidth Allocation Protocol (BAP) callback and set callback parameters, use the **ppp bap callback** command in interface configuration mode. To remove the PPP BAP callback configuration, use the **no** form of this command.

**ppp bap callback** {**accept** | **request** | **timer** *seconds*}

**no ppp bap callback** {**accept** | **request** | **timer**}

## Syntax Description

| | |
|---|---|
| **accept** | Local router initiates link addition upon peer notification. |
| **request** | Local router requests that a peer initiate link addition. |
| **timer** *seconds* | Number of seconds to wait between callback requests the router sends, in the range from 2 to 120 seconds. Disabled by default. |

## Defaults

Callback is disabled, and no callback parameters are set. The timer is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Examples

The following example configures a BRI interface for active mode BAP:

```
interface bri 0
 ip unnumbered ethernet 0
 dialer load-threshold 10 either
 dialer map ip 172.21.13.101 name bap-peer 14085778899
 encapsulation ppp
 ppp multilink bap
 ppp bap call request
 ppp bap callback accept
 no ppp bap call accept
 no ppp bap drop accept
 ppp bap pending timeout 30
 ppp bap number default 5664567
 ppp bap number secondary 5664568
```

## Related Commands

| Command | Description |
|---|---|
| **ppp bap drop** | Sets parameters for removing links from a multilink bundle. |
| **ppp bap link types** | Specifies the types of links that can be included in a specific multilink bundle. |
| **show ppp bap** | Displays the configuration settings and run-time status for a multilink bundle. |

# ppp bap drop

To set parameters for removing links from a multilink bundle, use the **ppp bap drop** command in interface configuration mode. To disable a specific type of default processing, use the **no** form of this command.

**ppp bap drop** {**accept** | **after-retries** | **request** | **timer** *seconds*}

**no ppp bap drop** {**accept** | **after-retries** | **request** | **timer**}

## Syntax Description

| | |
|---|---|
| **accept** | Peer can initiate link removal. Enabled by default. |
| **after-retries** | Local router can remove the link without Bandwidth Allocation Protocol (BAP) negotiation when no response to the drop requests arrives. |
| **request** | Local router can initiate removal of a link. Enabled by default. |
| **timer** *seconds* | Number of seconds to wait between drop requests sent. |

## Defaults

**accept**, **request**: Peers can initiate link removal and this router also can initiate link removal
**no ppp bap drop after-retries**: The link is not dropped when there is no response to drop requests
**timer**: Disabled, no default value is defined.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

The **no ppp bap drop accept** command disables the router's ability to respond favorably to link drop requests from a peer. However, the router can still remove the link when it receives such requests.

The **no ppp bap drop after-retries** command is the default behavior; the **ppp bap drop after-retries** command must be entered explicitly to be effective.

The **no ppp bap drop request** command disables the router's ability to send link drop requests to a peer. However, the peer can still remove the link on its own behalf; for example, when there is too little traffic to justify keeping the link up.

The **ppp bap max** command specifies the maximum number of requests and retries.

## Examples

The following partial example sets a 60-second wait between drop requests:

```
ppp bap drop timer 60
```

**Related Commands**

| Command | Description |
|---|---|
| **ppp bap max** | Sets upper limits on the number of retransmissions for PPP BAP. |

# ppp bap link types

To specify the types of links that can be included in a specific multilink bundle, use the **ppp bap link types** command in interface configuration mode. To remove a type of interface that was previously allowed to be added, use the **no** form of this command.

**ppp bap link types** [**isdn**] [**analog**]

**no ppp bap link types** [**isdn**] [**analog**]

## Syntax Description

| | |
|---|---|
| **isdn** | (Optional) ISDN interfaces can be added to a multilink bundle. This is the default. |
| **analog** | (Optional) Asynchronous serial interfaces can be added to a multilink bundle. |

## Defaults

**isdn**

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

The choice of keywords must suit the interfaces configured for Multilink PPP. For example, if you have configured a dialer rotary with only ISDN interfaces, only the **isdn** keyword would be appropriate. If the configuration allows both ISDN and asynchronous interfaces, both **isdn** and **analog** keywords could be used; the multilink bundle could then consist of both ISDN and asynchronous links. Bandwidth Allocation Protocol (BAP) dynamically determines which interfaces are applicable.

## Examples

The following example configures a dialer interface for passive mode BAP and for both ISDN and asynchronous serial links:

```
interface dialer 1
 ip unnumbered ethernet 0
 encapsulation ppp
 ppp multilink bap
 ppp bap call accept
 ppp bap link types isdn analog
 dialer load threshold 30
 ppp bap timeout pending 60
```

## Related Commands

| Command | Description |
|---|---|
| **ppp bap callback** | Enables PPP BAP callback and set callback parameters. |
| **show ppp bap** | Displays the configuration settings and run-time status for a multilink bundle. |

# ppp bap max

To set upper limits on the number of retransmissions for PPP Bandwidth Allocation Protocol (BAP), use the **ppp bap max** command in interface configuration mode. To remove any retry limit, use the **no** form of this command.

**ppp bap max** {**dial-attempts** *number* | **ind-retries** *number* | **req-retries** *number* | **dialers** *number*}

**no ppp bap max** {**dial-attempts** | **ind-retries** | **req-retries** | **dialers** *number*}

## Syntax Description

| | |
|---|---|
| **dial-attempts** *number* | Maximum number of dial attempts to any destination number, in the range from 1 to 3. The default is one dial attempt. |
| **ind-retries** *number* | Maximum number of retries of a call status indication message, in the range from 1 to 10. The default is three indication retries. |
| **req-retries** *number* | Maximum number of retries for a particular request, in the range from 1 to 5. The default is three request retries. |
| **dialers** *number* | Maximum number of free dialers logged, in the range from 1 to 10. The default is five free dialers. |

## Defaults

1 dial attempt
3 indication retries
3 request retries
5 searches for free dialers

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

In compliance with RFC 2125, the **no** form of this command explicitly removes any status indication retry limit and is displayed in the router configuration.

The **ppp bap max dialers** command works in conjunction with the **dialer rotor** and **dialer priority** interface commands, which can be used to determine free dialers based upon the priority or the best available. Dialers include all interfaces that are configured under the dialer group leader (the dialer interface itself). The dialer group leader is displayed as the Master Interface in the **show ppp bap group** output.

BAP bases its link type and phone number decisions upon the ordering of the interfaces. This decision is suited to a mixed media environment of both ISDN and analog interfaces, where it may be desirable to choose the ISDN link over the asynchronous or vice versa.

Note that this decision also will limit the number of potential phone numbers that can be included in a CallResponse or CallbackRequest; the maximum number is limited to 20. For example, ten BRI interfaces with two numbers per interface.

## Examples

The following partial example accepts the default number of attempts to dial a number and the default number of indication retries, but configures a limit of four times to send requests:

```
ppp bap max req-retries 4
```

## Related Commands

| Command | Description |
|---|---|
| **dialer priority** | Sets the priority of an interface in a dialer rotary group. |
| **dialer rotor** | Specifies the method for identifying the outbound line to be used for ISDN or asynchronous DDR calls. |
| **ppp bap drop** | Sets parameters for removing links from a multilink bundle. |
| **ppp bap monitor load** | Validates peer requests to add or remove links against the current bundle load and the defined dialer load threshold. |
| **ppp bap timeout** | Specifies nondefault timeout values for PPP BAP pending actions and responses. |
| **show ppp bap group** | Displays the configuration settings and run-time status for a multilink bundle. |

# ppp bap monitor load

To validate peer requests to add or remove links against the current bundle load and the defined dialer load threshold, use the **ppp bap monitor load** command in interface configuration mode. To specify that incoming link addition requests are not to be subject to the bundle load threshold, use the **no** form of this command.

**ppp bap monitor load**

**no ppp bap monitor load**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Command is enabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

If the load is being monitored and the incoming peer requests that a link be dropped when the current traffic load is above the dialer load (that is, there is enough traffic to justify the current number of links), the router will not drop the link. In addition, when the traffic falls below the threshold, Bandwidth Allocation Protocol (BAP) tries to drop a link.

The **no** form of this command indicates that incoming peer requests to add a link are not subject to the bundle load threshold. However, other criteria must be met before a favorable response is sent.

## Examples

The following partial example configures BAP not to validate peer requests against the current bundle load and the configured dialer load threshold:

```
no ppp bap monitor load
```

## Related Commands

| Command | Description |
|---|---|
| **dialer load-threshold** | Configures bandwidth on demand by setting the maximum load before the dialer places another call to a destination. |

# ppp bap number

To specify a local telephone number that peers can dial to establish a multilink bundle, use the **ppp bap number** command in interface configuration mode. To remove a previously configured number, use the **no** form of this command.

**ppp bap number** {**default** *phone-number* | **secondary** *phone-number* | **prefix** *prefix-number* | **format** {**national** | **subscriber**}}

**no ppp bap number** {**default** *phone-number* | **prefix** *prefix-number* | **format** {**national** | **subscriber**}}

## Syntax Description

| | |
|---|---|
| **default** *phone-number* | Primary (base) phone number for the interface and the number that can be used for incoming dial calls. |
| **secondary** *phone-number* | Telephone number for the second B channel. Applies only to BRI interfaces that have a different number for each B channel or to dialer interfaces that are BRIs. |
| **prefix** *prefix-number* | Prefix number for the PPP BAP phone number. |
| **format national** \| **subscriber** | Format for the primary phone number to be dialed should be either national or subscriber where the number of digits assigned to the number is as follows:<br>• Ten-digit number for a national format.<br>• Seven-digit number for a subscriber format. |

## Defaults

No base number is provided.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |
| 11.3 T | The **prefix** and **format** keywords were added. |

## Usage Guidelines

Use this command to supply a local default number to be exchanged between peers in order to establish a multilink bundle.

This command is applicable on both the dialer interface and the individual physical interfaces.

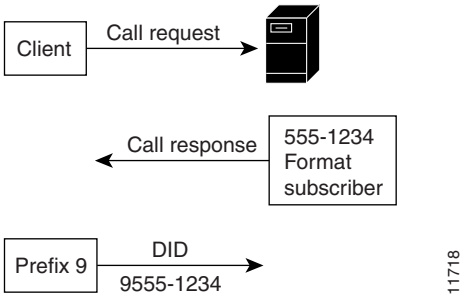
If a peer requests that a number be supplied and no PPP Bandwidth Allocation Protocol (BAP) default number is defined, it might not be possible for the peer to access the interface. However, the peer can access the interface if it has the number already or the number it dialed originally is the same as the number for establishing a Multilink PPP (MLP) bundle.

**Note** During BAP negotiations between peers, the called party indicates the number to call for BAP if it is different from the number the peer originally dialed. The called party responds with information about the phone number *delta* (the changes to be made in the right-most digits dialed). This information indicates the number of digits that are different from the number originally dialed and what those digits should be.

For example, if the remote peer dialed 5557659876, and the **ppp bap number** command had the default number 5557659912, the local router would respond "3 | 912." In the response, a vertical bar ( | ) is used to divide the number of digits to change from the number sequence to use instead. In the "3 | 912" response, the local router instructs the calling interface to replace the right-most three digits with "912" for BAP.

This command is used by the client side for dialing instructions when communicating with the server. Use the **prefix** keyword on the Always On/Dynamic ISDN (AO/DI) client side to specify what will precede any number dialed to a multilink peer. For example, the client issues a call request to the server whereby the server issues a call response that includes the dialing number the client should use and the format this number should be in (national or subscriber). The client then dials the number supplied by the server, preceded by any prefix information contained in the **ppp bap number prefix** command. Figure 3 shows an overview about the information exchange between the client and the server.

***Figure 3 Client and Server Response Sequence***




Use the **format** keyword on the AO/DI server side to specify how many digits should be returned by BAP. BAP will return the numbers based on either a national or subscriber format. The value that is returned is preceded by the prefix before dialing occurs. For example, if the **format national** keywords are configured, then the national format (which is equivalent to ten digits) is returned by BAP (during BAP negotiation) from the server.

**Note** The **ppp bap number prefix** and **ppp bap number format** keyword options cannot be combined to a single-string command line; they must be entered in two separate command strings.

## Examples

In the following example, the AO/DI client uses a **ppp bap prefix** value of 9, which indicates that the dialed number of 5551234 will be preceded by a 9. The number that is actually dialed is 95551234. The AO/DI server uses a subscriber format, which indicates that when the client asks the server for the numbers to dial, BAP will return seven digits.

### Client Router

```
interface dialer1
 ppp bap number prefix 9
```

### Server Router

```
interface dialer1
 ppp bap number format subscriber
 ppp bap number default 5555678
```

In the following example, the AO/DI client uses a **ppp bap prefix** value of 1, which indicates that the dialed number of 5551234 will be preceded by a 1. The number that is actually dialed is 19195555678 because the server is using a national format, and BAP therefore, returns ten digits.

### Client Router

```
interface dialer1
 ppp bap number prefix 1
```

### Server Router

```
interface dialer1
 ppp bap number format national
 ppp bap number default 9195555678
```

The following example configures a physical interface with both a default number and a secondary number:

```
interface bri 0
 ip unnumbered ethernet 0
 dialer load-threshold 10 either
 dialer map ip 172.21.13.101 name bap-peer 14085778899
 encapsulation ppp
 ppp multilink bap
 ppp bap call request
 ppp bap callback accept
 no ppp bap call accept
 no ppp bap drop accept
 ppp bap pending timeout 30
 ppp bap number default 5664567
 ppp bap number secondary 5664568
```

## Related Commands

| Command | Description |
|---|---|
| **ppp bap callback** | Enables PPP BAP callback and set callback parameters. |
| **show ppp bap** | Displays the configuration settings and run-time status for a multilink bundle. |

# ppp bap timeout

To specify nondefault timeout values for PPP Bandwidth Allocation Protocol (BAP) pending actions and responses, use the **ppp bap timeout** command in interface configuration mode. To reset the response timeout to the default value, or to remove a pending timeout entirely, use the **no** form of this command.

**ppp bap timeout** {**pending** *seconds* | **response** *seconds*}

**no ppp bap timeout** {**pending** | **response**}

## Syntax Description

| | |
|---|---|
| **pending** *seconds* | Number of seconds to wait before timing out pending actions, in the range from 2 to 180 seconds. The default is 20 seconds. |
| **response** *seconds* | Number of seconds to wait for a response before timing out, in the range from 2 to 120 seconds. The default is 3 seconds. |

## Defaults

Enabled

**pending**: 20 seconds

**response**: 3 seconds

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

The **no ppp bap timeout response** command resets the timer to the default value.The **no ppp bap timeout pending** command removes the pending-action timeout entirely (in compliance with the BAP specification).

## Examples

The following example configures BAP to wait 45 seconds before timing out pending actions:

```
interface dialer 1
 ip unnumbered ethernet 0
 encapsulation ppp
 ppp multilink bap
 ppp bap call accept
 ppp bap link types isdn analog
 dialer load threshold 30
 ppp bap timeout pending 45
```

## Related Commands

| Command | Description |
|---|---|
| **ppp bap callback** | Enables PPP BAP callback and set callback parameters. |
| **ppp bap drop** | Sets parameters for removing links from a multilink bundle. |
| **ppp bap max** | Sets upper limits on the number of retransmission for PPP BAP. |
| **show ppp bap** | Displays the configuration settings and run-time status for a multilink bundle. |

# ppp bridge appletalk

To enable half-bridging of AppleTalk packets across a serial interface, use the **ppp bridge appletalk** command in interface configuration mode. To disable AppleTalk packet half-bridging, use the **no** form of this command.

**ppp bridge appletalk**

**no ppp bridge appletalk**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.2 | This command was introduced. |

## Usage Guidelines

When you configure a serial or ISDN interface for half-bridging, you configure it to function as a node on an Ethernet subnetwork. It communicates with a bridge on the subnetwork by sending and receiving bridge packets. The serial or ISDN interface converts bridge packets to routed packets and forwards them, as needed.

The serial interface must be configured with an AppleTalk address for communication on the Ethernet subnetwork, and the AppleTalk address must have the same AppleTalk cable range as the bridge.

You cannot configure a serial interface for both half-bridging and for transparent bridging. No more than one half-bridge should be on any subnetwork.

## Examples

The following example configures serial interface 0 for half-bridging of AppleTalk. The remote bridge and other Ethernet nodes must be on the same network.

```
interface serial 0
 ppp bridge appletalk
 appletalk cable-range 301-301
 appletalk zone remote-lan
```

## Related Commands

| Command | Description |
|---|---|
| **appletalk cable-range** | Enables an extended AppleTalk network. |
| **appletalk zone** | Sets the zone name for the connected AppleTalk network. |
| **ppp bridge ip** | Enables half-bridging of IP packets across a serial interface. |
| **ppp bridge ipx** | Enables half-bridging of IPX packets across a serial interface. |

# ppp bridge ip

To enable half-bridging of IP packets across a serial interface, use the **ppp bridge ip** command in interface configuration mode. To disable IP packet half-bridging, use the **no** form of this command.

**ppp bridge ip**

**no ppp bridge ip**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.2 | This command was introduced. |

## Usage Guidelines

When you configure a serial or ISDN interface for half-bridging, you configure it to function as a node on an Ethernet subnetwork. It communicates with a bridge on the subnetwork by sending and receiving bridge packets. The serial interface converts bridge packets to routed packets and forwards them, as needed.

The interface must be configured with an IP address for communication on the Ethernet subnetwork, and the IP address must be on the same subnetwork as the bridge.

You cannot configure a serial interface for both half-bridging and for transparent bridging.

No more than one half-bridge should be on any subnetwork.

## Examples

The following example configures serial interface 0 for half-bridging of IP. The remote bridge and other Ethernet nodes must be on the same subnetwork.

```
interface serial 0
 ip address 172.19.5.8
 ppp bridge ip
```

## Related Commands

| Command | Description |
|---|---|
| **ip address** | Sets a primary or secondary IP address for an interface. |
| **ppp bridge appletalk** | Enables half-bridging of AppleTalk packets across a serial interfaces. |
| **ppp bridge ipx** | Enables half-bridging of IPX packets across a serial interfaces. |

# ppp bridge ipx

To enable half-bridging of Internetwork Packet Exchange (IPX) packets across a serial interface, use the **ppp bridge ipx** command in interface configuration mode. To return to the default Novell Ethernet_802.3 encapsulation, use the **no** form of this command.

**ppp bridge ipx** [**novell-ether** | **arpa** | **sap** | **snap**]

**no ppp bridge ipx**

## Syntax Description

| | |
|---|---|
| **novell-ether** | (Optional) Novell Ethernet_802.3 encapsulation. This is the default. |
| **arpa** | (Optional) Novell Ethernet_II encapsulation. |
| **sap** | (Optional) Novell Ethernet_802.2 encapsulation. |
| **snap** | (Optional) Novell Ethernet_Snap encapsulation. |

## Defaults

The default encapsulation is **novell-ether**.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.2 | This command was introduced. |

## Usage Guidelines

When you configure a serial interface for half-bridging, you configure it to function as a node on an Ethernet subnetwork. It communicates with a bridge on the subnetwork by sending and receiving bridge packets. The serial interface converts bridge packets to routed packets and forwards them, as needed.

The serial interface must be configured with an IPX address for communication on the Ethernet subnetwork, and the IPX address must be on the same subnetwork as the bridge.

You cannot configure a serial interface for both half-bridging and for transparent bridging.

No more than one half-bridge should be on any subnetwork.

## Examples

The following example configures serial interface 0 for half-bridging of IPX. The remote bridge and other Ethernet nodes must be on the same subnetwork.

```
interface serial 0
 ppp bridge ipx
 ipx network 1800
```

## Related Commands

| Command | Description |
|---|---|
| **ipx network** | Enables IPX routing on a particular interface and optionally selects the type of encapsulation (framing). |
| **ppp bridge appletalk** | Enables half-bridging of AppleTalk packets across a serial interfaces. |
| **ppp bridge ip** | Enables half-bridging of IP packets across a serial interfaces. |

# ppp callback (DDR)

To enable a dialer interface to function either as a callback client that requests callback or as a callback server that accepts callback requests, use the **ppp callback** command in interface configuration mode. To disable a function, use the **no** form of this command.

**ppp callback** {**accept** | **permit** | **request**}

**no ppp callback**

## Syntax Description

| | |
|---|---|
| **accept** | Dialer interface accepts PPP callback requests (and functions as the PPP callback server). |
| **permit** | Dialer interface permits PPP callback (and functions as the PPP callback client). |
| **request** | Dialer interface requests PPP callback (and functions as the PPP callback client). |

## Defaults

Callback requests are neither accepted nor requested.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.1 | This command was introduced. |

## Usage Guidelines

An interface can request PPP callback only if the interface is configured for PPP authentication with Challenge Handshake Authentication Protocol (CHAP) or Password Authentication Protocol (PAP).

## Examples

The following example configures a previously defined dialer interface to accept PPP callback requests:

```
ppp callback accept
```

## Related Commands

| Command | Description |
|---|---|
| **dialer callback-secure** | Enables callback security. |
| **map-class dialer** | Defines a class of shared configuration parameters associated with the **dialer map** command for outgoing calls from an ISDN interface and for PPP callback. |
| **ppp callback (PPP client)** | Enables a PPP client to dial in to an asynchronous interface and request a callback. |

# ppp callback (PPP client)

To enable a PPP client to dial in to an asynchronous interface and request a callback, use the **ppp callback** command in interface configuration mode. To disable callback acceptance, use the **no** form of this command.

**ppp callback** {**accept** | **initiate**}

**no ppp callback**

## Syntax Description

| | |
|---|---|
| **accept** | Accept callback requests from RFC 1570-compliant PPP clients on the interface. |
| **initiate** | Initiate a callback to non-RFC 1570-compliant PPP clients dialing in to an asynchronous interface. |

## Defaults

Callback requests are not accepted on asynchronous interfaces.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.0 | This command was introduced. |

## Usage Guidelines

PPP callback can be initiated only if the interface is configured for authentication using CHAP or PAP.

## Examples

The following example accepts a callback request from an RFC-compliant PPP client:

```
ppp callback accept
```

The following example accepts a callback request from a non-RFC-compliant PPP client:

```
ppp callback initiate
```

## Related Commands

| Command | Description |
|---|---|
| **arap callback** | Enables an ARA client to request a callback from an ARA client. |
| **autoselect ppp** | Configures a line to start a SLIP session. |
| **call progress tone country** | Forces the Cisco IOS software to wait before initiating a callback to a requesting client. |
| **ppp authentication** | Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface. |

| Command | Description |
|---|---|
| **ppp callback (DDR)** | Enables a dialer interface to function either as a callback client that requests callback or as a callback server that accepts callback requests. |
| **username** | Establishes a username-based authentication system, such as PPP CHAP and PAP. |

# ppp caller name

To set the caller option when no Calling Line Identification (CLID) is available, use the **ppp caller name** command in interface configuration mode. To remove the name, use the **no** form of this command.

**ppp caller name** *name*

**no ppp caller name** *name*

## Syntax Description

| | |
|---|---|
| *name* | Username string for this call. |

## Defaults

Command is disabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

This command sets the username used when the CLID is not available. This username is used only in the case where the **ppp dnis** command is configured and the CLID is not available.

## Examples

The following example shows how to configure a call to user1:

```
interface Serial0:15
 description "PRI D channel"
 ip unnumbered Loopback0
 encapsulation ppp
 no keepalive
 dialer pool-member 1 max-link 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp caller name user1
 ppp authentication pap chap callin USERS&TUNNELS
 ppp chap hostname osh
```

## Related Commands

| Command | Description |
|---|---|
| **ppp dnis** | Sets the DNIS string for a PPP call. |

# ppp dnis

To configure a set of dialed number identification service (DNIS) numbers to check an incoming call against to automatically authenticate and authorize a user, use the **ppp dnis** command in interface configuration mode. To remove the numbers, use the **no** form of this command.

**ppp dnis** *DNIS-numbers*

**no ppp dnis** *DNIS-numbers*

## Syntax Description

| | |
|---|---|
| *DNIS-numbers* | Set of DNIS numbers that will be checked when a call comes in. |

## Defaults

This command is disabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

This command enables a method of authenticating and authorizing a user based on the DNIS. The DNIS is the number dialed by the user. If the dialed number for this session matches one of the numbers configured in the **ppp dnis** command, the user is automatically authenticated and authorized for the session. Any other configured PPP authentication is not performed. In the case of DNIS authentication, the Calling Line Identification (CLID) is used as the username. If the CLID is unavailable, the username is the name configured with the **ppp caller name** command. If neither the CLID nor a caller name is configured, the username will automatically be set to "no-clid."

## Examples

The following example shows how to set the DNIS for a call:

```
interface Serial0:15
 description "PRI D channel"
 ip unnumbered Loopback0
 encapsulation ppp
 no keepalive
 dialer pool-member 1 max-link 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp dnis 13693 132
 ppp authentication pap chap callin USERS&TUNNELS
 ppp chap hostname osh
```

**Related Commands**

| Command | Description |
|---|---|
| **ppp caller name** | Sets the caller option when no CLID is available. |

# ppp encrypt mppe

To enable Microsoft Point-to-Point Encryption (MPPE) on the virtual template, use the **ppp encrypt mppe** command in interface configuration mode. To disable MPPE, use the **no** form of this command.

**ppp encrypt mppe** {**auto** | **40** | **128**} [**passive** | **required**] [**stateful**]

**no ppp encrypt mppe**

## Syntax Description

| | |
|---|---|
| **auto** | All available encryption strengths are allowed. |
| **40** | Only 40-bit encryption is allowed. |
| **128** | Only 128-bit encryption is allowed. |
| **passive** | (Optional) MPPE will not offer encryption, but will negotiate if the other tunnel endpoint requests encryption. |
| **required** | (Optional) MPPE must be negotiated, or the connection will be terminated. |
| **stateful** | (Optional) MPPE will negotiate only stateful encryption. If the **stateful** keyword is not used, MPPE will first attempt to negotiate stateless encryption, but will allow stateful mode if the other tunnel endpoint requests it. |

## Command Default

MPPE encryption is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(5)XE5 | This command was introduced. |
| 12.1(5)T | This command was integrated into Cisco IOS Release 12.1(5)T. |

## Usage Guidelines

To use the **ppp encrypt mppe** command, PPP encapsulation must be enabled.

**Note** The **ppp authentication ms-chap** command must be added to the interface that will carry Point-to-Point Tunnel Protocol (PPTP)-MPPE traffic. All Windows clients using MPPE need the Microsoft MS-CHAP application. This is a Microsoft design requirement.

The **auto** keyword is offered only on 128-bit images.

All of the configurable MPPE options must be identical on both tunnel endpoints.

**Note** Stateful encryption is not appropriate for links that have high loss rates because the state information is updated with each packet received, but cannot be updated correctly for packets that are not received. Losing a packet means loss of state (transmissions are no longer synchronous). Losing state triggers expensive resynchronization mechanisms, and more packets will be lost during the recovery period. Any link that experiences more than the occasional random drop is therefore unsuitable for stateful encryption mechanisms. The same is also true for stateful compressions. For this reason, stateful encryption may not be appropriate for lossy network environments such as Layer 2 tunnels on the Internet.

## Examples

The following example shows a virtual template configured to perform 40-bit MPPE encryption:

```
interface Virtual-Template1
 ip unnumbered FastEthernet0/0
 no ip directed-broadcast
 ip mroute-cache
 no keepalive
 ppp encrypt mppe 40
 ppp authentication ms-chap
```

## Related Commands

| Command | Description |
|---|---|
| **encryption mppe** | Enables MPPE encryption on the ISA card. |
| **interface virtual-template** | Creates a virtual template interface. |
| **ppp authentication** | Enables CHAP, PAP, MS-CHAP, or a combination of methods and specifies the order in which the authentication methods are selected on the interface. |

# ppp ipcp

To configure PPP IP Control Protocol (IPCP) features such as the ability to provide primary and secondary Domain Name Server (DNS) and Windows Internet Naming Service (WINS) server addresses, and the ability to accept any address requested by a peer, use the **ppp ipcp** command in template or interface configuration mode. To disable a **ppp ipcp** feature, use the **no** form of this command.

**ppp ipcp** {**accept-address**} | {**dns** {**reject** | **accept** | *primary-ip-address* [*secondary-ip-address*] [**accept**]} | {**ignore-map**} | {**username unique**} | {**wins** {**reject** | **accept** | *primary-ip-address* [*secondary-ip-address*] [**accept**]}}}

**no ppp ipcp** {**accept-address**} | {**dns** {**reject** | **accept** | *primary-ip-address* [*secondary-ip-address*] [**accept**]} | {**ignore-map**} | {**username unique**} | {**wins** {**reject** | **accept** | *primary-ip-address* [*secondary-ip-address*] [**accept**]}}}

## Syntax Description

| | |
|---|---|
| **accept-address** | Accepts any nonzero IP address from the peer. |
| **dns** | Domain Name Server. |
| **reject** | Rejects the IPCP option if received from the peer. |
| **accept** | (Optional) Accepts a peer request for any nonzero server address. |
| *primary-ip-address* | IP address of the primary DNS or WINS server. |
| *secondary-ip-address* | (Optional) IP address of the secondary DNS or WINS server. |
| **ignore-map** | Ignores dialer map when negotiating peer IP address. |
| **username unique** | Ignores a common username when providing an IP address to the peer. |
| **wins** | Windows Internet Naming Service. |

## Defaults

No servers are configured, and no address request is made.

## Command Modes

Template configuration
interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(6)T | This command was introduced. |
| 12.1(5)T | The **reject** and **accept** keywords were added. |

## Usage Guidelines

To negate a command, the **dns**, **wins**, **accept-address**, **ignore-map**, and **username unique** keywords can be entered without addresses or other options. See the examples for clarification.

## Examples

The following examples show use of the **ppp ipcp** command:

```
ppp ipcp accept-address
```

```
ppp ipcp dns 10.1.1.3

ppp ipcp dns 10.1.1.3 10.1.1.4

ppp ipcp dns 10.1.1.1 10.1.1.2 accept

ppp ipcp dns accept

ppp ipcp dns reject

ppp ipcp ignore-map

ppp ipcp username unique

ppp ipcp wins 10.1.1.1 10.1.1.2

ppp ipcp wins accept
```

The following examples show how to use the **no** form of the **ppp ipcp** command:

```
no ppp ipcp wins 10.1.1.1 10.1.1.2

no ppp ipcp wins

no ppp ipcp ignore-map
```

## Related Commands

| Command | Description |
|---|---|
| **debug ppp** | Displays information on traffic and exchanges in an internetwork implementing the PPP. |
| **show interfaces** | Displays statistics for all interfaces configured on the router or access server. |
| **show ip interfaces** | Displays the usability status of interfaces configured for IP. |

# ppp iphc max-header

To set the maximum size of the largest IP header that may be compressed when configuring Internet Protocol Header Compression (IPHC) control options over PPP, use the **ppp iphc max-header** command in interface configuration mode. To change the configuration, use the **no** form of this command.

**ppp iphc max-header** *bytes*

**no ppp iphc max-header** *bytes*

## Syntax Description

| | |
|---|---|
| *bytes* | Maximum size, in bytes, of the largest IP header that may be compressed. The range is from 60 to 168 bytes, and the default is 168 bytes. |

## Defaults

168 bytes

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

There are two types of IP header compression used over PPP: Van Jacobsen header compression defined in RFC 1332 and enabled with the **ip tcp header-compression** command, and IPHC defined in RFC 2509 and enabled with the **ip rtp header-compression** command. The **ppp iphc** set of commands controls parameters that pertain to the form of IPHC described in RFC 2509.

The IPHC specification allows low speed links to run more efficiently by reducing the size of the IP headers as transmitted on the link. IPHC supports compressed Real-Time Transport Protocol (cRTP), compressed User Datagram Protocol (cUDP), and compressed Transaction Control Protocol (cTCP).

An IPHC-enabled interface sends only changes to the header instead of sending the entire header with every packet. At the beginning of a transmission, the transmitting end (the compressor) sends a full header packet to the receiving end (the decompressor). After the initial packet is sent, the compressor sends all other packets with headers that contain only the differences between them and the original full header. The decompressor maintains a copy of the original full header and reconstructs all the other packet headers by adding the changes to them.

The header data that is different with each packet is referred to as the session state, and is identified by a session ID or connection ID.

When the decompressor receives a compressed packet, it reconstructs the packet header by adding the difference to the saved uncompressed header. Typically, IPHC enables the header to be compressed to two bytes (four bytes if UDP checksums are used).

The following fields in a packet header usually remain the same throughout a transmission:

- IP source and destination addresses
- UDP and TCP source and destination ports

- RTP synchronization source (SSRC) fields

The following fields in a packet header usually change during a transmission:

- IP packet ID
- Checksum
- Sequence number
- RTP time stamp
- The RTP marker bit

## Examples

The following example shows how to change the maximum size of the largest IP header that may be compressed from the default of 168 bytes to 114 bytes:

```
interface Multilink1
 ip address 10.100.253.1 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 ip tcp header-compression iphc-format
 no ip mroute-cache
 fair-queue 64 256 1000
 no cdp enable
 ppp multilink
 ppp multilink fragment-delay 20
 ppp multilink interleave
 multilink-group 1
 ip rtp header-compression iphc-format
 ip rtp priority 16384 50 64
 ppp iphc max-header 114
 ppp iphc max-time 10
 ppp iphc max-period 512
```

## Related Commands

| Command | Description |
|---|---|
| **ip rtp header-compression** | Enables TCP, UDP, and RTP (RFC 2509) header compression. |
| **ip tcp header-compression** | Enables TCP (RFC 1332) header compression. |
| **ppp iphc max-period** | Sets the maximum number of compressed packets that can be sent before a full header when configuring IPHC control options over PPP. |
| **ppp iphc max-time** | Sets the maximum time allowed between full headers when configuring IPHC control options over PPP. |

# ppp iphc max-period

To set the maximum number of compressed packets that can be sent before a full header when configuring Internet Protocol Header Compression (IPHC) control options over PPP, use the **ppp iphc max-period** command in interface configuration mode. To change the configuration, use the **no** form of this command.

**ppp iphc max-period** *packets*

**no ppp iphc max-period** *packets*

## Syntax Description

| | |
|---|---|
| *packets* | Maximum number of compressed packets that can be sent before a full header. The range is from 1 to 65,535 packets, and the default is 256 packets. |

## Defaults

256 packets

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

There are two types of IP header compression used over PPP: Van Jacobsen header compression, which is defined in RFC 1332, and a newer compression type described in RFC 2509. The **ppp iphc** set of commands controls parameters that pertain to the form of IPHC described in RFC 2509.

The IPHC specification allows low speed links to run more efficiently when IP headers are extremely large. IPHC supports compressed Real-Time Transport Protocol (cRTP), compressed User Datagram Protocol (cUDP), and compressed Transaction Control Protocol (cTCP).

An IPHC-enabled interface sends only changes to the header instead of sending the entire header with every packet. At the beginning of a transmission, the transmitting end (the compressor) sends a full header packet to the receiving end (the decompressor). After the initial packet is sent, the compressor sends all other packets with headers that contain only the differences between them and the original full header. The decompressor maintains a copy of the original full header and reconstructs all the other packet headers by adding the changes to them.

The header data that is different with each packet is referred to as the session state, and is identified by a session ID or connection ID.

When the decompressor receives a compressed packet, it reconstructs the packet header by adding the difference to the saved uncompressed header. Typically, IPHC enables the header to be compressed to two bytes (four bytes if UDP checksums are used).

The following fields in a packet header usually remain the same throughout a transmission:

- IP source and destination addresses
- UDP and TCP source and destination ports

- RTP synchronization source (SSRC) fields

The following fields in a packet header usually change during a transmission:

- IP packet ID
- Checksum
- Sequence number
- RTP time stamp
- RTP marker bit

The **ppp iphc max-period** command is specifically related to an IPHC frame format known as *compressed_non_TCP*. The recovery of lost compressed_non_TCP frames on lossy links is much improved by allowing more full headers to flow and by configuring less compression.

## Examples

The following example shows how to increase the maximum number of compressed packets that can be sent before a full header from 256 to 512 packets when configuring IPHC control options over PPP:

```
interface Multilink1
 ip address 10.100.253.1 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 ip tcp header-compression iphc-format
 no ip mroute-cache
 fair-queue 64 256 1000
 no cdp enable
 ppp multilink
 ppp multilink fragment-delay 20
 ppp multilink interleave
 multilink-group 1
 ip rtp header-compression iphc-format
 ip rtp priority 16384 50 64
 ppp iphc max-header 114
 ppp iphc max-time 10
 ppp iphc max-period 512
```

## Related Commands

| Command | Description |
|---|---|
| **ip rtp header-compression** | Enables TCP, UDP, and RTP (RFC 2509) header compression. |
| **ip tcp header-compression** | Enables TCP (RFC 1332) header compression. |
| **ppp iphc max-header** | Sets the maximum size of the largest IP header that may be compressed when configuring IPHC control options over PPP. |
| **ppp iphc max-time** | Sets the maximum number of compressed packets that can be sent before a full header when configuring IPHC control options over PPP. |

# ppp iphc max-time

To set the maximum time allowed between full headers when configuring Internet Protocol Header Compression (IPHC) control options over PPP, use the **ppp iphc max-time** command in interface configuration mode. To change the configuration, use the **no** form of this command.

**ppp iphc max-time** *seconds*

**no ppp iphc max-time** *seconds*

## Syntax Description

| | |
|---|---|
| *seconds* | Maximum time, in seconds, allowed between full headers. The range is from 1 to 255 seconds, and the default is 5 seconds. |

## Defaults

5 seconds

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

There are two forms of IP header compression used over PPP: Van Jacobsen header compression, which is defined in RFC 1332, and a newer form of compression described in RFC 2509. The **ppp iphc** set of commands controls parameters that pertain to the form of IPHC described in RFC 2509.

The IPHC specification allows low speed links to run more efficiently by reducing the size of IP headers as transmitted on the link. IPHC supports compressed Real-Time Transport Protocol (cRTP), compressed User Datagram Protocol (cUDP), and compressed Transaction Control Protocol (cTCP).

An IPHC-enabled interface sends only changes to the header instead of sending the entire header with every packet. At the beginning of a transmission, the transmitting end (the compressor) sends a full header packet to the receiving end (the decompressor). After the initial packet is sent, the compressor sends all other packets with headers that contain only the differences between them and the original full header. The decompressor maintains a copy of the original full header and reconstructs all the other packet headers by adding the changes to them.

The header data that is different with each packet is referred to as the session state, and is identified by a session ID or connection ID.

When the decompressor receives a compressed packet, it reconstructs the packet header by adding the difference to the saved uncompressed header. Typically, IPHC enables the header to be compressed to two bytes (four bytes if UDP checksums are used).

The following fields in a packet header usually remain the same throughout a transmission:

- IP source and destination addresses
- UDP and TCP source and destination ports
- RTP synchronization source (SSRC) fields

The following fields in a packet header usually change during a transmission:

- IP packet ID
- Checksum
- Sequence number
- RTP time stamp
- RTP marker bit

The **ppp iphc max-time** command is specifically related to an IPHC frame format known as *compressed_non_TCP*. The recovery of lost compressed_non_TCP frames on lossy links is much improved by allowing more full headers to flow and by configuring less compression.

## Examples

The following example shows how to change the number of compressed packets that can be sent before a full header from the default 5 seconds to 10 seconds:

```
interface Multilink1
 ip address 10.100.253.1 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 ip tcp header-compression iphc-format
 no ip mroute-cache
 fair-queue 64 256 1000
 no cdp enable
 ppp multilink
 ppp multilink fragment-delay 20
 ppp multilink interleave
 multilink-group 1
 ip rtp header-compression iphc-format
 ip rtp priority 16384 50 64
 ppp iphc max-header 114
 ppp iphc max-time 10
 ppp iphc max-period 512
```

## Related Commands

| Command | Description |
|---|---|
| **ip rtp header-compression** | Enables TCP, UDP, and RTP (RFC 2509) header compression. |
| **ip tcp header-compression** | Enables TCP (RFC 1332) header compression. |
| **ppp iphc max-header** | Sets the maximum size of the largest IP header that may be compressed when configuring IPHC control options over PPP. |
| **ppp iphc max-period** | Sets the maximum number of compressed packets that can be sent before a full header when configuring IPHC control options over PPP. |

# ppp lcp delay

To set a delay before initiating link control protocol (LCP) negotiations after a link connects, use the **ppp lcp delay** command in interface configuration mode. To remove the delay, use the **no** form of this command.

**ppp lcp delay** *seconds*

**no ppp lcp delay** *seconds*

## Syntax Description

| | |
|---|---|
| **delay** *seconds* | Delay, in seconds, before initiating LCP negotiations. |

## Defaults

Default is 2 seconds.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.1 | This command was introduced. |

## Usage Guidelines

The delay setting is for those situations in which it is desired that PPP does not initiate LCP negotiations with a peer system after the link has come up, but instead waits for a short amount of time to let the peer send the first packet.

The LCP delay is applied only to incoming connections. PPP does not delay for outbound connections or connections where PPP cannot determine a direction.

## Examples

The following example sets the delay to 4 seconds:

```
ppp lcp delay 4
```

# ppp lcp fast-start

To allow a PPP interface to respond immediately to incoming packets once a connection is established, use the **ppp lcp fast-start** command in interface configuration mode. To specify that PPP delay before responding, use the **no** form of this command.

**ppp lcp fast-start**

**no ppp lcp fast-start**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Command is enabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

Some systems, typically those with external modems, may have problems with slow or electrically noisy hardware. If the **no ppp lcp fast-start** command is specified, PPP starts a debounce timer and waits for it to expire before attempting to communicate with the peer system, thereby reducing the probability of a false start on the interface.

If the **no ppp lcp fast-start** command is not specified, PPP will not use a debounce timer and will respond immediately to incoming packets once a connection is made.

The default fast start enabled state should not be disabled unless there is a problem with slow or electronically noisy hardware. This setting prevents PPP from waiting for a debounce timer to expire before responding to inbound frames.

## Examples

The following example disables fast start:

```
no ppp lcp fast-start
```

# ppp link reorders

To set an advisory flag that indicates the serial interface may receive packets in a different order than a peer system sent them, use the **ppp link reorders** command in interface configuration mode. To turn this flag off, use the **no** form of this command.

**ppp link reorders**

**no ppp link reorders**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.2 | This command was introduced. |

## Usage Guidelines

The **ppp link reorders** command indicates that a link can receive packets in a different order than the peer system sent them. This situation can be encountered with PPP tunneling mechanisms such as Layer 2 Forwarding (L2F) and the Layer 2 Transport Protocol (L2TP) that do not always enforce strictly serial delivery of frames from source to final destination. Such links can pose problems for PPP features that depend upon in-order delivery of packets, such as compression, encryption, network header compression, and Multilink PPP.

Setting this option allows some PPP systems to compensate to an extent for the nonserial delivery of packets, although this compensation can incur a performance penalty. It is not normally necessary to configure the **ppp link reorders** command. PPP automatically recognizes that the condition exists for Virtual Private Network (VPN) tunnels, and the misdelivery situation will not occur on normal serial interfaces.

## Examples

The following example sets the **ppp link reorders** command advisory flag:

```
ppp link reorders
```

# ppp loopback ignore

To disable PPP loopback detection, use the **ppp loopback ignore** command in interface configuration mode. To reenable PPP loopback detection (the default condition), use the **no** form of this command.

**ppp loopback ignore**

**no ppp loopback ignore**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Loopback detection is enabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **ppp ignore-loopback**. |
| 12.2(5)T | The **ppp loopback ignore** command replaced the **ppp ignore-loopback** command. |

## Usage Guidelines

A circuit loopback normally indicates faulty external switching equipment or wiring errors. The PPP protocol includes a mechanism that detects when a circuit is looped back, that is, when the circuit is fed back upon itself such that the router is reading its own output on that link. A first phase of loopback detection occurs during Link Control Protocol (LCP) negotiation when the circuit is being established. A loopback condition that occurs after the connection is made (after LCP negotiation) can be detected if link keepalives are enabled. If keepalives are disabled on the link, the second phase of loopback detection is not available.

The normal operation (default) is for PPP to check for a loopback condition and terminate the connection when a loopback is detected. There are, however, some situations where it is necessary to disable loopback detection, such as during certain testing situations, or when software detects problematic peers that do not implement the PPP protocol correctly. The **ppp loopback ignore** command disables normal operation; the **no ppp loopback ignore** command restores normal operation.

**Note** Loopback detection depends upon successful negotiation of the LCP Magic Number option during link establishment. Some implementations may not support this option.

## Examples

The following example shows PPP loopback detection being disabled:

```
interface Serial0:15
 description "PRI D channel"
 ip unnumbered Loopback0
 encapsulation ppp
 ppp loopback ignore
```

**Related Commands**

| Command | Description |
|---|---|
| **keepalive** | Configures a keepalive packet that is sent at a certain time interval, and for a certain number of retries if there is no response, to keep an interface active. |

# ppp max-bad-auth

To configure a point-to-point interface not to reset itself immediately after an authentication failure but instead to allow a specified number of authentication retries, use the **ppp max-bad-auth** command in interface configuration mode. To reset to the default of immediate reset, use the **no** form of this command.

**ppp max-bad-auth** *retries*

**no ppp max-bad-auth**

## Syntax Description

| | |
|---|---|
| *retries* | Number of retries after which the interface is to reset itself. Default is 0. |

## Defaults

The default is 0.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.2 | This command was introduced. |

## Usage Guidelines

This command applies to any serial interface (asynchronous serial, synchronous serial, or ISDN) on which PPP encapsulation is enabled.

## Examples

The following example sets BRI interface 0 to allow two additional retries after an initial authentication failure (for a total of three failed authentication attempts):

```
interface bri 0
 encapsulation ppp
 ppp authentication chap
 ppp max-bad-auth 3
```

## Related Commands

| Command | Description |
|---|---|
| **exec** | Allows an EXEC process on a line. |

# ppp mru match

To trigger Link Control Protocol (LCP) renegotiation on a maximum receive unit (MRU) mismatch on a system acting as an L2TP network server (LNS) and thereby enforce strict matching, use the **ppp mru match** command in interface configuration mode. To remove this setting, use the **no** form of this command.

**ppp mru match**

**no ppp mru match**

## Syntax Description

This command has no arguments or keywords.

## Defaults

This command is disabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.2(12)T | This command was introduced. |

## Usage Guidelines

This command is configured only on virtual template interfaces.

By default, the LNS does not enforce matching of the MRU value advertised by the LAC with the MRU value that the LNS would advertise. Use the **ppp mru match** command to enforce strict matching of the MRU that is advertised by the Layer 2 Tunneling Protocol (L2TP) access concentrator (LAC) with the maximum transmission unit (MTU) of the relevant virtual template interface on the LNS. A mismatch can occur because the effective MRU size for a virtual access interface is not necessarily limited to the MTU size.

This command can be useful to inform the client PPP stack of the true MRU, when that PPP implementation is capable of adapting its MTU based on LCP MRU negotiation.

## Examples

The following example shows LCP renegotiation being triggered on an MRU mismatch:

```
interface Virtual-Template1
 mtu 1454
 ppp mru match
 ip unnumbered GigabitEthernet0/1
 no keepalive
 peer default ip address pool mypool
 ppp authentication pap
```

## Related Commands

| Command | Description |
|---|---|
| **ppp mtu adaptive** | Defines autonegotiation of the MTU size for PPP. |

# ppp ms-chap refuse

To refuse Microsoft Challenge Handshake Authentication Protocol (MS-CHAP) authentication from peers requesting it, use the **ppp ms-chap refuse** command in interface configuration mode. To allow MS-CHAP authentication, use the **no** form of this command.

**ppp ms-chap refuse** [**callin**]

**no ppp ms-chap refuse** [**callin**]

## Syntax Description

| | |
|---|---|
| **callin** | (Optional) Specifies that the router will refuse to answer MS-CHAP authentication challenges received from the peer, but will still require the peer to answer any MS-CHAP challenges the router sends. |

## Defaults

This command is disabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

This command specifies that MS-CHAP authentication is disabled for all calls, meaning that all attempts by the peer to force the user to authenticate using MS-CHAP will be refused. If the **callin** keyword is used, MS-CHAP authentication is disabled for incoming calls from the peer, but will still be performed on outgoing calls to the peer.

If outbound Password Authentication Protocol (PAP) has been enabled (using the **ppp pap sent-username** command), PAP will be suggested as the authentication method in the refusal packet.

## Examples

The following example shows how to disable MS-CHAP authentication if a peer calls in requesting MS-CHAP authentication. The method of encapsulation on interface ISDN BRI number 0 is PPP.

```
interface bri 0
 encapsulation ppp
 ppp ms-chap refuse
```

## Related Commands

| Command | Description |
|---|---|
| **aaa authentication ppp** | Specifies one or more AAA authentication methods for use on serial interfaces running PPP. |
| **ppp authentication** | Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface. |

| Command | Description |
|---|---|
| **ppp authentication ms-chap-v2** | Creates a pool of dialup routers that all appear to be the same host when authenticating with CHAP. |
| **ppp chap password** | Enables a router calling a collection of routers that do not support this command (such as routers running older Cisco IOS software images) to configure a common CHAP secret password to use in response to challenges from an unknown peer. |
| **ppp chap wait** | Specifies that the router will not authenticate to a peer requesting CHAP authentication until after the peer has authenticated itself to the router. |
| **ppp pap sent-username** | Reenables remote PAP support for an interface and use the sent-username and password in the PAP authentication request packet to the peer. |

# ppp ms-chap-v2 refuse

To refuse Microsoft Challenge Handshake Authentication Protocol (MS-CHAP) version 2 authentication from peers requesting it, use the **ppp ms-chap-v2 refuse** command in interface configuration mode. To allow MS-CHAP version 2 authentication, use the **no** form of this command.

**ppp ms-chap-v2 refuse** [**callin**]

**no ppp ms-chap-v2 refuse** [**callin**]

## Syntax Description

| | |
|---|---|
| **callin** | (Optional) Specifies that the router will refuse to answer MS-CHAP authentication challenges received from the peer, but will still require the peer to answer any MS-CHAP challenges the router sends. |

## Defaults

This command is disabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

This command specifies that MS-CHAP version 2 authentication is disabled for all calls, meaning that all attempts by the peer to force the user to authenticate using MS-CHAP version 2 will be refused. If the **callin** keyword is used, MS-CHAP version 2 authentication is disabled for incoming calls from the peer, but will still be performed on outgoing calls to the peer.

If outbound Password Authentication Protocol (PAP) has been enabled (using the **ppp pap sent-username** command), PAP will be suggested as the authentication method in the refusal packet.

## Examples

The following example shows how to disable MS-CHAP version 2 authentication if a peer calls in requesting MS-CHAP version 2 authentication. The method of encapsulation on interface ISDN BRI number 0 is PPP.

```
interface bri 0
 encapsulation ppp
 ppp ms-chap-v2 refuse
```

## Related Commands

| Command | Description |
|---|---|
| **aaa authentication ppp** | Specifies one or more AAA authentication methods for use on serial interfaces running PPP. |
| **ppp authentication** | Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface. |

| Command | Description |
|---|---|
| **ppp authentication ms-chap-v2** | Creates a pool of dialup routers that all appear to be the same host when authenticating with CHAP. |
| **ppp chap password** | Enables a router calling a collection of routers that do not support this command (such as routers running older Cisco IOS software images) to configure a common CHAP secret password to use in response to challenges from an unknown peer. |
| **ppp chap wait** | Specifies that the router will not authenticate to a peer requesting CHAP authentication until after the peer has authenticated itself to the router. |
| **ppp pap sent-username** | Reenables remote PAP support for an interface and use the sent-username and password in the PAP authentication request packet to the peer. |

# ppp mtu adaptive

To define autonegotiation of the MTU size for PPP based on the peer or proxy maximum receive unit (MRU), use the **ppp mtu adaptive** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**ppp mtu adaptive** [**proxy**]

**no ppp mtu adaptive** [**proxy**]

## Syntax Description

| | |
|---|---|
| **proxy** | (Optional) Adapt the MTU to the proxy MRU, that is, the MRU negotiated by a system such as an L2TP Access Concentrator (LAC) that has performed Link Control Protocol (LCP) negotiation on behalf of the Cisco router and forwarded the negotiated LCP options, including the MRU. |

## Defaults

This command is disabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.2(7) | This command was introduced, and was supported on only virtual templates. |
| 12.2(13)T | The **proxy** keyword was added. |
| 12.3(14)T | This command without the **proxy** keyword was supported on serial interfaces. |

## Usage Guidelines

By default, the Cisco IOS software will not adapt the interface MTU to the peer or proxy MRU.

Use this command on interfaces where a number of peers with different MRU settings may connect. In Cisco IOS Release 12.2(7) and later releases, this command is configured on only virtual template interfaces. In Cisco IOS Release 12.3(14)T and later releases, the **ppp mtu adaptive** command *without* the **proxy** keyword can be configured on serial interfaces.

The **proxy** keyword is not typically required. It is used only as a workaround when the client PPP stack is incapable of correctly advertising its MRU requirements.

## Examples

The following example defines autonegotiation of the MTU size on a virtual template:

```
interface Virtual-Template1
 no ip address
 no logging event link-status
 no snmp trap link-status
 ppp mtu adaptive
 ppp authentication chap callin
```

**Related Commands**

| Command | Description |
|---|---|
| **ppp mtu match** | Triggers LCP renegotiation on an MRU mismatch. |

# ppp multilink

To enable Multilink PPP (MLP) on an interface and, optionally, to enable Bandwidth Allocation Control Protocol (BACP) and Bandwidth Allocation Protocol (BAP) for dynamic bandwidth allocation, use the **ppp multilink** command in interface configuration mode. To disable Multilink PPP or, optionally, to disable only dynamic bandwidth allocation, use the **no** form of this command.

**ppp multilink** [**bap**]

**no ppp multilink** [**bap** [**required**]]

## Syntax Description

| | |
|---|---|
| **bap** | (Optional) Specifies bandwidth allocation control negotiation and dynamic allocation of bandwidth on a link. |
| **required** | (Optional) Enforces mandatory negotiation of BACP for the multilink bundle. The multilink bundle is disconnected if BACP is not negotiated. |

## Defaults

Command is disabled. When BACP is enabled, the defaults are to accept calls and to set the timeout pending at 30 seconds.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.1 | This command was introduced. |

## Usage Guidelines

This command applies only to interfaces that use PPP encapsulation.

MLP and PPP reliable links do not work together.

When the **ppp multilink** command is used, the first channel will negotiate the appropriate Network Control Protocol (NCP) layers (such as the IP Control Protocol and IPX Control Protocol), but subsequent links will negotiate only the link control protocol and MLP. NCP layers do not get negotiated on these links, and it is normal to see these layers in a closed state.

This command with the **bap** keyword must be used before configuring any **ppp bap** commands and options. If the **bap required** option is configured and a reject of the options is received, the multilink bundle is torn down.

The **no** form of this command without the **bap** keyword disables both MLP and BACP on the interface.

The **dialer load-threshold** command enables a rotary group to bring up additional links and to add them to a multilink bundle.

Before Cisco IOS Release 11.1, the **dialer-load threshold 1** command kept a multilink bundle of any number of links connected indefinitely and the **dialer-load threshold 2** command kept a multilink bundle of two links connected indefinitely. If you want a multilink bundle to be connected indefinitely, you must set a very high idle timer.

## Examples

The following partial example configures a dialer for Multilink PPP; it does not show the configuration of the physical interfaces:

```
interface Dialer0
 ip address 10.0.0.2 255.0.0.0
 encapsulation ppp
 dialer in-band
 dialer idle-timeout 500
 dialer map ip 10.0.0.1 name atlanta broadcast 81012345678901
 dialer load-threshold 30 either
 dialer-group 1
 ppp authentication chap
 ppp multilink
```

## Related Commands

| Command | Description |
|---|---|
| **compress** | Configures compression for LAPB, PPP, and HDLC encapsulations. |
| **dialer fast-idle (interface)** | Specifies the idle time before the line is disconnected. |
| **dialer-group** | Controls access by configuring an interface to belong to a specific dialing group. |
| **dialer load-threshold** | Configures bandwidth on demand by setting the maximum load before the dialer places another call to a destination. |
| **encapsulation ppp** | Enables PPP encapsulation. |
| **ppp authentication** | Enables CHAP or PAP or both, and specifies the order in which CHAP and PAP authentication is selected on the interface. |
| **ppp bap timeout** | Specifies nondefault timeout values for PPP BACP pending actions and responses. |
| **show ppp bap** | Displays the configuration settings and run-time status for a multilink bundle. |

# ppp multilink endpoint

To override or change the default endpoint discriminator the system uses when negotiating the use of Multilink PPP (MLP) with the peer, use the **ppp multilink endpoint** command in interface configuration mode. To restore the default endpoint discriminator, use the **no** form of this command.

**ppp multilink endpoint** {**hostname** | **ip** *ip-address* | **mac** *lan-interface* | **none** | **phone** *telephone-number* | **string** *char-string*}

**no ppp multilink endpoint**

## Syntax Description

| | |
|---|---|
| **hostname** | Uses the host name configured for the router. This is useful when multiple routers are using the same username to authenticate, but have different host names. |
| **ip** *ip-address* | Uses the supplied IP address. |
| **mac** *lan-interface* | Uses the specified LAN interface whose MAC address is to be used. |
| **none** | Causes negotiation of the link control protocol without requesting the endpoint discriminator option. This is useful when the router is connected to a malfunctioning peer that does not handle the endpoint discriminator option properly. |
| **phone** *telephone-number* | Uses the supplied telephone number, and accepts E.164-compliant, full international telephone numbers. |
| **string** *char-string* | Uses the supplied character string. |

## Defaults

The default endpoint discriminator is the globally configured host name, or the Challenge Handshake Authentication Protocol (CHAP) host name or Password Authentication Protocol (PAP) sent-username configured on the interface. See the "Usage Guidelines" for additional information.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.2 | This command was introduced. |

## Usage Guidelines

By default, PPP uses the same string for the endpoint discriminator that it would provide for authentication to negotiate use of MLP with the peer. The string (username) is configured for the interface with the **ppp chap hostname** or **ppp pap sent-username** command, or defaults to the globally configured host name (or stack group name, if the interface is a Stack Group Bidding Protocol, or SGBP, group member). The keywords supplied with the **ppp multilink endpoint** command allow a different endpoint discriminator to be defined. You can reset the default condition by entering the **no ppp multilink endpoint** command.

The difference between the **no ppp multilink endpoint** command and the **ppp multilink endpoint hostname** command is that for the first command, MLP supplies the name used for authentication (which may or may not be the router host name), and the second command always uses the router host name, regardless of any local authentication configuration.

Both the **hostname** and **string** keywords use the local endpoint class, the differences between them being that the **string** keyword allows you to enter a value, while the **hostname** keyword uses the configured (default) host name.

**Note** Do not configure the **ppp multilink endpoint** command on MLP bundle interfaces. Configure this command on each interface that will be an MLP bundle member, not on the bundle interface itself.

Refer to RFC 1990 for more information about MLP and the endpoint discriminator option.

## Examples

The following partial example changes the endpoint discriminator from the CHAP host named group 1 to IP address 10.1.1.4:

```
.
.
.
interface Dialer0
 ip address 10.1.1.4 255.255.255.0
 encapsulation ppp
 dialer remote-name R-name
 dialer string 23456
 dialer pool 1
 dialer-group 1
 ppp chap hostname group 1
 ppp multilink endpoint ip 10.1.1.4
.
.
.
```

## Related Commands

| Command | Description |
|---|---|
| **multilink bundle-name** | Selects a method for naming multilink bundles. |
| **ppp chap hostname** | Creates a pool of dialup routers that all appear to be the same host when authenticating with CHAP. |
| **ppp pap sent-username** | Reenables remote PAP support for an interface and uses the sent-username and password in the PAP authentication request packet to the peer. |
| **sgbp member** | Specifies the host name and IP address of a router or access server that is a peer member of a stack group. |

# ppp multilink fragment delay

To specify a maximum size in units of time for packet fragments on a Multilink PPP (MLP) bundle, use the **ppp multilink fragment delay** command in interface configuration mode. To reset the maximum delay to the default value, use the **no** form of this command.

**ppp multilink fragment delay** *delay-max*

**no ppp multilink fragment delay**

## Syntax Description

| | |
|---|---|
| *delay-max* | Maximum amount of time, in milliseconds, that should be required to transmit a fragment. The range is from 1 to 1000 milliseconds. |

## Defaults

No default behavior or values are set, but MLP requires a time delay value and will assume a value 30 milliseconds.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **ppp multilink fragment-delay**. |
| 12.2 | The command was changed to **ppp multilink fragment delay**. |

## Usage Guidelines

By default, MLP has no fragment size constraint and packets are divided into a number of fragments whose number is based on the number of links in the bundle. The size of any fragment is unconstrained, but the maximum number of fragments is constrained by the number of links. If interleaving is enabled, or if the bundle contains links that have differing bandwidths, or if a fragment delay is explicitly configured with the **ppp multilink fragment delay** command, then MLP uses a different fragmentation algorithm. In this mode, the number of fragments is unconstrained, but the size of each fragment is limited to the fragment delay value, or 30 milliseconds if the fragment delay has not been configured.

The **ppp multilink fragment delay** command is useful when packets are interleaved and traffic characteristics such as delay, jitter, and load balancing must be tightly controlled.

The **ppp multilink fragment delay** command applies only to interfaces that can configure a bundle interface, such as virtual templates, dialer interfaces, and ISDN BRI or PRI interfaces.

The value assigned to the *delay-max* argument is scaled by the speed at which a link can convert the time value into a byte value. If a bundle has multiple links with varying speeds, the absolute size of a fragment will differ for each link.

MLP chooses a fragment size on the basis of the maximum delay allowed. If real-time traffic requires a certain maximum bound on delay, using this command to set that maximum time can ensure that a real-time packet will get interleaved within the fragments of a large packet.

## Examples

The following example requires a voice interface to have a maximum bound on delay of 20 milliseconds:

```
ppp multilink fragment delay 20
```

## Related Commands

| Command | Description |
|---|---|
| **ppp multilink** | Enables MLP on an interface and, optionally, enables dynamic bandwidth allocation. |
| **ppp multilink fragment disable** | Enables or suppresses packet fragmentation on an MLP bundle. |
| **ppp multilink fragmentation** | Sets the maximum number of fragments a packet will be segmented into before being sent over the bundle. |
| **ppp multilink interleave** | Enables MLP interleaving. |

# ppp multilink fragment disable

To disable packet fragmentation, use the **ppp multilink fragment disable** command in interface configuration mode. To enable fragmentation, use the **no** form of this command.

**ppp multilink fragment disable**

**no ppp multilink fragment disable**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Fragmentation is enabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **ppp multilink fragmentation**. |
| 12.2 | The **no ppp multilink fragmentation** command was changed to **ppp multilink fragment disable**. The **no ppp multilink fragmentation** command is still recognized and accepted by Cisco IOS Release 12.2. |

## Usage Guidelines

Disable multilink fragmentation using the **ppp multilink fragment disable** command if fragmentation causes performance degradation. Performance degradation due to multilink fragmentation has been observed with asynchronous member links. This command does not disable fragmentation completely. When fragmentation is mandatory (e. g. when a bundle level packet exceeds the member link MTU size), it will still be performed.

## Examples

The following example disables packet fragmentation:

```
ppp multilink fragment disable
```

## Related Commands

| Command | Description |
|---|---|
| **ppp multilink fragment delay** | Specifies a maximum size, in units of time, for packet fragments on an MLP bundle. |
| **ppp multilink interleave** | Enables MLP interleaving. |

# ppp multilink fragmentation

The **ppp multilink fragmentation** command is replaced by the **ppp multilink fragment disable** command. See the description of the **ppp multilink fragment disable** command for more information.

# ppp multilink fragment maximum

To set the maximum number of fragments a packet will be segmented into before being sent over the bundle, use the **ppp multilink fragment maximum** command in interface configuration mode. To reset fragmentation to the default value, use the **no** form of this command.

**ppp multilink fragment maximum** *fragments*

**no ppp multilink fragment maximum**

## Syntax Description

| | |
|---|---|
| *fragments* | Maximum number of fragments in the range from 1 to 16. |

## Defaults

16 fragments

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **multilink max-fragments**. |
| 12.2 | This command was changed to **ppp multilink fragment maximum**. The **multilink max-fragments** command will be accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

Use the **ppp multilink fragment maximum** command to control the number of fragments into which a PPP frame may be fragmented. The **ppp multilink fragment maximum** command has been used to disable fragmentation entirely by setting the number of fragments to 1. This setting is better accomplished using the **ppp multilink fragment disable** command.

The limit set using the **ppp multilink fragment maximum** command applies only when Multilink PPP (MLP) is fragmenting packets in a mode where it is constraining the number of fragments rather than the size of the fragments. See the description about fragmentation modes in the section "Usage Guidelines" of the **ppp multilink fragment delay** command for more details.

## Examples

The following example uses the **ppp multilink fragment maximum** command to fragment each frame into no more than four fragments:

```
ppp multilink fragment maximum 4
```

## Related Commands

| Command | Description |
|---|---|
| **ppp multilink fragment delay** | Specifies a maximum size, in units of time, for packet fragments on an MLP bundle. |
| **ppp multilink fragment disable** | Disables packet fragmentation. |

# ppp multilink group

To restrict a physical link to joining only a designated multilink-group interface, use the **ppp multilink group** command in interface configuration mode. To remove the restrictions, use the **no** form of this command.

**ppp multilink group** *group-number*

**no ppp multilink group**

## Syntax Description

| | |
|---|---|
| *group-number* | Multilink-group number (a nonzero number). |

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(3)T | This command was introduced as **multilink-group**. |
| 12.2 | This command was changed to **ppp multilink group**. The **multilink-group** command will be accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

By default this command is disabled, which means the link can negotiate to join any bundle in the system.

When the **ppp multilink group** command is configured, the physical link is restricted from joining any but the designated multilink-group interface. If a peer at the other end of the link tries to join a different bundle, the connection is severed. This restriction applies when Multilink PPP (MLP) is negotiated between the local end and the peer system. The link can still come up as a regular PPP interface.

This command is primarily used with the MLP inverse multiplexer described in the "Configuring Media-Independent PPP and Multilink PPP" chapter in the *Cisco IOS Dial Technologies Configuration Guide*, Release 12.2.

## Examples

The following example designates serial interface 1 as part of multilink bundle 1:

```
interface serial 1
 encapsulation ppp
 ppp multilink group 1
 ppp multilink
 ppp authentication chap
 pulse-time 3
```

**Related Commands**

| Command | Description |
|---|---|
| interface multilink | Creates a multilink bundle or enters multilink interface configuration mode. |

# ppp multilink idle-link

To configure a multilink bundle so that the slowest link enters into receive-only mode when a link is added, use the **ppp multilink idle-link** command in interface configuration mode. To remove the idle link flag, use the **no** form of this command.

**ppp multilink idle-link**

**no ppp multilink idle-link**

## Syntax Description

This command has no arguments or keywords.

## Defaults

**no ppp multilink idle-link**

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 T | This command was introduced. |

## Usage Guidelines

When the idle link flag is enabled, Multilink PPP (MLP) places the slowest link in a bundle into an idle receive-only mode whenever the bundle has more than one link.

This mode is used for the Always On/Dynamic ISDN (AO/DI) feature, where a bundle contains one permanent slow-speed member link, which is on an X.25 circuit contained on an ISDN D channel. As additional and faster links join the MLP bundle, the D channel circuit will be idled and traffic confined to the faster links.

The **ppp multilink idle-link** command was intended specifically to enable the AO/DI feature. The command will work on any bundle, but normally should not be used outside the AO/DI environment.

## Examples

The following example configures the interface (dialer interface 1) to add links to the MLP bundle once the traffic load on the primary link is reached:

```
interface dialer1
 ppp multilink idle-link
```

# ppp multilink interleave

To enable interleaving of packets among the fragments of larger packets on a Multilink PPP (MLP) bundle, use the **ppp multilink interleave** command in interface configuration mode. To disable interleaving, use the **no** form of this command.

**ppp multilink interleave**

**no ppp multilink interleave**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Interleaving is disabled by default.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |
| 12.2(4)T3 | This command was introduced on the VIP-enabled Cisco 7500 series routers as part of the Distributed Link Fragmentation and Interleaving feature. The Distributed Link Fragmentation and Interleaving feature introduced this command for ATM and Frame Relay only. |
| 12.2(8)T | This command was introduced for leased lines on VIP-enabled Cisco 7500 series routers. |

## Usage Guidelines

The **ppp multilink interleave** command applies only to interfaces that can configure a bundle interface, such as virtual templates, dialer interfaces, multilink interfaces, and ISDN BRI or PRI interfaces. For the Versatile Interface Processor (VIP)-enabled Cisco 7500 series routers, this command can be configured using only virtual template interfaces configured for ATM and Frame Relay.

Interleaving works only when the queueing mode on the bundle has been set to fair queueing (all platforms *except* the VIP-enabled Cisco 7500 series routers) or to Distributed Low Latency Queueing (dLLQ) for the the VIP-enabled Cisco 7500 series routers.

On the VIP-enabled Cisco 7500 series routers, distributed Cisco Express Forwarding (dCEF) must be enabled, and dLLQ configured using the **priority** command in policy map configuration mode, before using the **ppp multilink interleave** command.

For all platforms except the VIP-enabled Cisco 7500 series routers, the **ppp multilink interleave** command should not be set unless weighted fair queueing (WFQ) has been configured using the default **fair-queue** command.

If interleaving is enabled when fragment delay is not configured, the default delay is 30 milliseconds. The fragment size is derived from that delay, depending on the bandwidths of the links.

## Examples

The following example defines a virtual interface template that enables MLP interleaving and a maximum real-time traffic delay of 20 milliseconds, and then applies that virtual template to the MLP bundle:

```
interface virtual-template 1
 ip unnumbered ethernet 0
 ppp multilink
 ppp multilink interleave
 ppp multilink fragment delay 20
!
multilink virtual-template 1
```

The following example shows the configuration of link fragmentation and interleaving (LFI) using MLP running on top of a PPP link over Frame Relay using a virtual template interface:

```
class-map voip
 match ip precedence 5
!
class-map business
 match ip precedence 3
!
policy-map llq-policy
 class voip
  priority 32
 class business
  bandwidth 32
!
policy-map shape-llq-policy
 class class-default
  shape average 80000 320 320
  service-policy llq-policy
!
policy-map input-policy
 class voip
  police 32000 1500 1500 conform-action transmit exceed-action drop
!
controller T1 5/1/0
 framing esf
 linecode b8zs
 channel-group 0 timeslots 1-2
!
interface Serial5/1/0:0
 no ip address
 encapsulation frame-relay
!
interface Serial5/1/0:0.1 point-to-point
 frame-relay interface-dlci 20 ppp Virtual-Template2
!
interface Virtual-Template2
 bandwidth 78
 ip unnumbered Loopback1
 no keepalive
 service-policy output llq-policy
 service-policy input input-policy
 ppp multilink
 ppp multilink fragment-delay 8
 ppp multilink interleave
```

The following example shows the configuration of LFI using MLP running on top of a PPPoATM link on an ATM interface. This configuration uses a virtual template interface.

```
class-map voip
 match ip precedence 5
!
class-map business
 match ip precedence 3
!
policy-map llq-policy
 class voip
  priority 32
 class business
  bandwidth 32
!
policy-map input-policy
 class voip
  police 32000 1500 1500 conform-action transmit exceed-action drop
!
interface ATM4/0/0
 no ip address
 no atm ilmi-keepalive
!
interface ATM4/0/0.1 point-to-point
 pvc 0/34
 abr 100 80
 protocol ppp Virtual-Template4
!
interface Virtual-Template4
 bandwidth 78
 ip unnumbered Loopback1
 service-policy output llq-policy
 service-policy input input-policy
 ppp multilink
!
class-map voip
 match ip precedence 5
!
class-map business
 match ip precedence 3
!
policy-map llq-policy
 class voip
  priority 32
 class business
  bandwidth 32
!
policy-map input-policy
 class voip
  police 32000 1500 1500 conform-action transmit exceed-action drop
!
interface ATM4/0/0
 no ip address
 no atm ilmi-keepalive
!
interface ATM4/0/0.1 point-to-point
 pvc 0/34
 abr 100 80
 protocol ppp Virtual-Template4
!
interface Virtual-Template4
 bandwidth 78
 ip address 10.0.0.2 255.0.0.0
 service-policy output llq-policy
```

```
 service-policy input input-policy
 ppp multilink
 ppp multilink fragment-delay 8
 ppp multilink interleave
 ppp multilink fragment-delay 8
 ppp multilink interleave
```

The following example shows the configuration of LFI over a leased line:

```
class-map voip
 match ip precedence 5
!
class-map business
 match ip precedence 3
!
policy-map llq-policy
 class voip
  priority 32
 class business
  bandwidth 32
!
policy-map input-policy
 class voip
  police 32000 1500 1500 conform-action transmit exceed-action drop
!
controller T1 5/1/0
 channel group 0 timeslots 1-2
!
interface multilink 2
 ip address 172.16.0.0 255.0.0.0
 keepalive 5
 bandwidth 128
 ppp multilink
 ppp multilink fragment-delay 8
 ppp multilink interleave
 service-policy output llq-policy
 service-policy input input-policy
 multilink-group 2
!
interface serial5/0/0:0
 no ip address
 encapsulation ppp
 keepalive 5
 ppp chap hostname G2
 ppp multilink
 multilink-group 2
```

The following example shows a simple leased line interleaving configuration using a virtual access interface bundle and default WFQ:

```
multilink virtual-template 10
!
interface serial0
 no ip address
 encapsulation ppp
 ppp multilink
!
interface virtual-template10
 ip unnumbered Ethernet0
 fair-queue
 ppp multilink
 ppp multilink interleave
```

The following example shows a simple leased line interleaving configuration using a dedicated multilink interface:

```
interface serial1
 no ip address
 encapsulation ppp
 ppp multilink
 ppp multilink-group 5
!
interface multilink5
 ip address 25.25.25.25 255.255.255.0
 fair-queue
 ppp multilink
 ppp multilink interleave
```

## Related Commands

| Command | Description |
|---|---|
| **ppp multilink fragment delay** | Specifies a maximum size, in units of time, for packet fragments on an MLP bundle. |
| **show ppp multilink** | Displays bundle information for the MLP bundles and their PPP links in the router. |

# ppp multilink links maximum

To limit the maximum number of links that Multilink PPP (MLP) can dial for dynamic allocation, use the **ppp multilink links maximum** command in interface configuration mode. To reset the default value, use the **no** form of this command.

**ppp multilink links maximum** *links*

**no ppp multilink links maximum**

## Syntax Description

| | |
|---|---|
| *links* | Maximum number of links, in the range from 1 to 255. |

## Defaults

255 links

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **ppp multilink max-link**. |
| 12.2 | This command was changed to **ppp multilink links maximum**. The **ppp multilink max-link** command will be accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

The value set in the **ppp multilink links maximum** command specifies the maximum number of links allowed in a bundle. When more links than the number assigned with the **ppp multilink links maximum** command try to enter the bundle, MLP hangs up its dialer channels to reduce the number of links.

Member links that are not dialer lines are not affected by settings in the **ppp multilink links maximum** command. If a bundle contains a mix of leased and dialer links, the leased lines count against the total, but the leased lines remain as permanent member links and will do so even if the value specified for the maximum number of links is exceeded.

Use this command to fine-tune the **ppp multilink load-threshold** command settings and to prevent runaway expansion of a bundle when a low threshold is set.

This command affects only dial-on-demand dynamic bandwidth environments.

## Examples

The following example sets the maximum number of links to 50:

```
ppp multilink links maximum 50
```

## Related Commands

| Command | Description |
|---|---|
| **ppp multilink links minimum** | Specifies the preferred minimum number of links in an MLP bundle. |

# ppp multilink links minimum

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

**ppp multilink links minimum** *links*

**no ppp multilink links minimum**

## Syntax Description

| | |
|---|---|
| *links* | Minimum number of links, in the range from 0 to 255. |

## Defaults

0 links

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as the **multilink min-links** command, |
| 12.1(11b)E | The **mandatory** keyword was added to the **multilink min-links** command. |
| 12.2 | The **multilink min-links** command was replaced by the **ppp multilink links minimum** command. The **multilink min-link** command was accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

If a bundle contains fewer links than is specified 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 the specified limit.

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

The value set in the **ppp multilink links minimum** 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.

This command affects only dial-on-demand dynamic bandwidth environments.

## Examples

The following example sets the minimum number of links to 12:

```
ppp multilink links minimum 12
```

**Related Commands**

| Command | Description |
|---|---|
| ppp multilink links maximum | Limits the maximum number of links that MLP can dial for dynamic allocation. |

# ppp multilink load-threshold

To enable Multilink PPP (MLP) to monitor traffic load and prompt dialer capability to adjust bandwidth to fit the load, use the **ppp multilink load-threshold** command in interface configuration mode. To disable this function, use the **no** form of this command.

**ppp multilink load-threshold** *load-threshold* [**outbound | inbound | either**]

**no ppp multilink load-threshold** *load-threshold* [**outbound | inbound | either**]

## Syntax Description

| | |
|---|---|
| *load-threshold* | Load threshold at which to consider adding or dropping a link, expressed as a value in the range from 1 to 255. A value of 255 indicates a 100 percent load. A value of 1 is a special case indicating any load at all; MLP will add as many links as it can, ignoring the actual traffic load. |
| **outbound** | (Optional) Only the outbound (transmit) traffic load is examined. |
| **inbound** | (Optional) Only the inbound (receive) traffic load is examined. |
| **either** | (Optional) Either the transmit or receive traffic load can trigger a link addition or subtraction. |

## Defaults

No active dynamic bandwidth mechanisms. If a *load-threshold* argument is configured without any of the optional keywords, the link defaults to examining outbound traffic load (**outbound**).

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **multilink load-threshold**. |
| 12.2 | This command was changed to **ppp multilink load-threshold.** The **multilink load-threshold** command will be accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

The **dialer load-threshold** command is generally configured instead of the **ppp multilink load-threshold** command, and MLP inherits the values set by the **dialer load-threshold** command when a bundle configuration is taken from a dialer interface.

Use the **ppp multilink load-threshold** command for dynamic bandwidth (dial-on-demand) systems in which MLP will need to dial additional links as needed to increase the bandwidth of a connection. When the load on the bundle interface exceeds the set value, links are added. When the load on the bundle interface drops below the set value, links are dropped.

## Examples

The following example sets the MLP inbound load threshold to 10:

```
ppp multilink load-threshold 10 inbound
```

## Related Commands

| Command | Description |
|---|---|
| **dialer load-threshold** | Configures bandwidth on demand by setting the maximum load before the dialer places another call to a destination. |
| **ppp multilink links maximum** | Limits the maximum number of links that MLP can dial for dynamic allocation. |
| **ppp multilink links minimum** | Specifies the preferred minimum number of links in an MLP bundle. |

# ppp multilink slippage

To define the constraints that set the Multilink PPP (MLP) reorder buffer size, use the **ppp multilink slippage** command in interface configuration mode. To remove the restriction, use the **no** form of this command.

**ppp multilink slippage** [**mru** *value* | **msec** *value*]

**no ppp multilink slippage** [**mru** *value* | **msec** *value*]

## Syntax Description

| | |
|---|---|
| **mru** *value* | Specifies the buffer limit is at least this many maximum receive units (MRUs) worth of data, in bytes. Valid values are 2 to 32. |
| **msec** *value* | Specifies the buffer limit is at least this many milliseconds worth of data. Valid range is 1 to 16000. |

## Defaults

The **mru** *value* default is 8 bytes.

There is no default for **msec** *value*.

## Command Modes

Interface configuration

## Command History

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

## Usage Guidelines

The slippage constraints are interface-level configuration commands, which may be placed on any interface or configuration source ultimately providing the configuration for a multilink bundle interface like “interface Multilink” and “interface dialer.”

Limits are on a “per-link” basis. For example, issuing **ppp multilink slippage mru 4** means that the total amount of data which is buffered by the bundle is 4 times the MRU times the number of links in the bundle.

The reassembly engine is also affected by the lost fragment timeout, which is configured using the **ppp timeout multilink lost-fragment** command.

The buffer limit derived from the slippage constraints implies a corresponding tolerated differential delay between the links. Since it does not make sense to be declaring a fragment lost due to a timeout when it is within the delay window defined by the slippage, the timeout will be dynamically increased as necessary so that it is never smaller than the delay value derived from the slippage parameters.

In addition, the two commands **ppp multilink slippage mru** and **ppp multilink slippage msec** may be used separately or at the same time.

## Examples

The following example shows the total amount of data buffered by the bundle is 4 times the MRU times the number of links in the bundle:

```
Router(config)# interface multilink 8
Router(config-if)# ip address 172.16.48.209 255.255.0.0
Router(config-if)# ppp multilink slippage mru 4

Router(config)# interface dialer8
Router(config-if)# encapsulation ppp
Router(config-if)# ip address 172.16.48.209 255.255.0.0
Router(config-if)# ppp multilink slippage mru 4
Router(config-if)# ppp multilink slippage msec 16000
```

The following example shows configuring Multilink PPP over serial interface links on a multilink group interface. In this example, there are two Serial interfaces that are members of "interface multilink8". It is assumed that Serial2 interface has the bandwidth of 64kbps and Serial3 interface has the bandwidth of 128kbps. With these two Serial links, interface Multilink8 will have a bandwidth equal to 64kbps + 128kbps = 196 kbps or 24.5 kBps [b=bit, B=byte]. The interface Multilink8 is configured with "ppp multilink slippage msec 2000" and therefore buffers at least 2000 milliseconds worth of data which means it buffers at least 2000 ms * 24.5 kBps = 49000 bytes.

```
Router(config)# interface Multilink8
Router(config-if)# ip address 172.16.48.209 255.255.0.0
Router(config-if)# ppp multilink
Router(config-if)# ppp multilink slippage msec 2000
Router(config-if)# ppp multilink group 8

Router(config)# interface Serial2
Router(config-if)# no ip address
Router(config-if)# encapsulation ppp
Router(config-if)# ppp multilink group 8

Router(config)# interface Serial3
Router(config-if)# no ip address
Router(config-if)# encapsulation ppp
Router(config-if)# ppp multilink group 8
```

## Related Commands

| Command | Description |
|---|---|
| **ppp multilink** | Enables MLP on an interface and, optionally, enables dynamic bandwidth allocation. |
| **ppp multilink fragment delay** | Specifies a maximum time for the transmission of a packet fragment on a MLP bundle. |
| **ppp multilink fragment disable** | Disables packet fragmentation. |
| **ppp multilink fragmentation** | Sets the maximum number of fragments a packet will be segmented into before being sent over the bundle. |
| **ppp multilink group** | Restricts a physical link to joining only a designated multilink-group interface. |
| **ppp multilink interleave** | Enables MLP interleaving. |
| **ppp multilink mrru** | Configures the Maximum Receive Reconstructed Unit (MRRU) value negotiated on a MLP bundle. |

# ppp quality

To enable Link Quality Monitoring (LQM) on a serial interface, use the **ppp quality** command in interface configuration mode. To disable LQM, use the **no** form of this command.

**ppp quality** *percentage*

**no ppp quality**

## Syntax Description

| | |
|---|---|
| *percentage* | Specifies the link quality threshold. Range is from 1 to 100. |

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 10.0 | This command was introduced. |

## Usage Guidelines

The percentages are calculated for both incoming and outgoing directions. The outgoing quality is calculated by comparing the total number of packets and bytes sent to the total number of packets and bytes received by the destination node. The incoming quality is calculated by comparing the total number of packets and bytes received to the total number of packets and bytes sent by the destination node.

If the link quality percentage is not maintained, the link is deemed to be of poor quality and is taken down. LQM implements a time lag so that the link does not bounce up and down.

## Examples

The following example enables LQM on serial interface 2:

```
interface serial 2
 encapsulation ppp
 ppp quality 80
```

## Related Commands

| Command | Description |
|---|---|
| **exec** | Allows an EXEC process on a line. |
| **keepalive** | Sets the keepalive timer for a specific interface. |

# ppp reliable-link

To enable Link Access Procedure, Balanced (LAPB) Numbered Mode negotiation for a reliable serial link, use the **ppp reliable-link** command in interface configuration mode. To disable negotiation for a PPP reliable link on a specified interface, use the **no** form of the command.

**ppp reliable-link**

**no ppp reliable-link**

## Syntax Description

This command has no arguments and keywords.

## Defaults

Command is disabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.0 | This command was introduced. |

## Usage Guidelines

Enabling LAPB Numbered Mode negotiation as a means of providing a reliable link does not guarantee that all connections through the specified interface will in fact use a reliable link. It guarantees only that the router will attempt to negotiate reliable link on this interface.

PPP reliable link can be used with PPP compression over the link, but it does not require PPP compression.

PPP reliable link does not work with Multilink PPP.

You can use the **show interface** command to determine whether LAPB has been established on the link. You can troubleshoot PPP reliable link by using the **debug lapb** command and the **debug ppp negotiations**, **debug ppp errors**, and **debug ppp packets** commands.

## Examples

The following example enables PPP reliable link and predictor compression on BRI interface 0:

```
interface bri 0
 description Enables predictor compression on BRI 0
 ip address 172.16.1.1 255.255.255.0
 encapsulation ppp
 dialer map ip 172.16.1.2 name starbuck 15555291357
 compress predictor
 ppp authentication chap
 dialer-group 1
 ppp reliable-link
```

## Related Commands

| Command | Description |
|---|---|
| **compress** | Configures compression for LAPB, PPP, and HDLC encapsulations. |
| **debug lapb** | Displays all traffic for interfaces using LAPB encapsulation. |
| **debug ppp** | Displays information on traffic and exchanges in an internetwork implementing the PPP. |
| **show interfaces** | Displays statistics for all interfaces configured on the router or access server. |

# ppp timeout authentication

To set PPP authentication timeout parameters, use the **ppp timeout authentication** command in interface configuration mode. To reset the default value, use the **no** form of this command.

**ppp timeout authentication** *response-time*

**no ppp timeout authentication**

## Syntax Description

| | |
|---|---|
| *response-time* | Maximum time, in seconds, to wait for a response to an authentication packet. Default is 10 seconds. |

## Defaults

10 seconds

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Examples

The following example changes the time to wait for a response to an authentication packet to 15 seconds:

```
ppp timeout authentication 15
```

## Related Commands

| Command | Description |
|---|---|
| **ppp timeout retry** | Sets PPP timeout retry parameters. |

# ppp timeout idle

To set PPP idle timeout parameters, use the **ppp timeout idle** command in interface configuration mode. To reset the time value, use the **no** form of this command.

**ppp timeout idle** *idle-time*

**no ppp timeout idle** *idle-time*

## Syntax Description

| | |
|---|---|
| *idle-time* | Line idle time, in seconds, allowed before disconnecting line. Acceptable range is from 1 to 2147483 seconds. |

## Defaults

No default behavior or values.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **ppp idle-timeout**. |
| 12.2 | This command was changed to **ppp timeout idle**. The **ppp idle-timeout** command will be accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

The **ppp timeout idle** command is used mainly on dialup interfaces and other temporary circuits to control how long the connection can be idle before it is terminated. All user traffic will reset the idle timer; however non-network traffic such as PPP control packets will not reset the timer. Also note that the dialer subsystem supports an alternate idle link detection mechanism that can be used instead of or with this PPP idle link detection mechanism.

## Examples

The following example sets the idle timer to 15 seconds:

```
ppp timeout idle 15
```

## Related Commands

| Command | Description |
|---|---|
| **absolute-timeout** | Sets the interval for closing user connections on a specific line or port. |
| **dialer fast-idle (interface)** | Specifies the amount of time that a line for which there is contention will stay idle before it is disconnected and the competing call is placed. |
| **dialer hold-queue** | Allows interesting outgoing packets to be queued until a modem connection is established. |
| **dialer idle-timeout (interface)** | Specifies the idle time before the line is disconnected. |

# ppp timeout multilink link add

To limit the amount of time for which Multilink PPP (MLP) waits for a call to be established, use the **ppp timeout multilink link add** command in interface configuration mode. To remove the value, use the **no** form of this command.

**ppp timeout multilink link add** *wait-period*

**no ppp timeout multilink link add**

## Syntax Description

| | |
|---|---|
| *wait-period* | Wait period, in seconds, in the range from 1 to 65535 seconds. |

## Defaults

No default behavior or values.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

When MLP needs to increase the bandwidth of a bundle, it attempts to bring up an additional link by requesting that the dialer system place a call to the peer system, or if the Bandwidth Allocation Protocol (BAP) is used, the call may also be done by requesting that the peer system make the call. BAP can be used to either make the call or request that the peer system make the call, depending upon the configuration. The time value specified with the **ppp timeout multilink link add** command determines how long MLP waits for that call to be established. If a new link does not join the bundle within the specified time, it is assumed that the call failed, and the call is attempted again.

If there are not enough links to carry the load, and the call succeeds in less than the time specified with the **ppp timeout multilink link add** command, MLP can immediately request another link. The time value specified with the **ppp timeout multilink link add** command prevents flooding the dialer system with call requests because not enough time was provided for prior requests to finish.

If the **ppp timeout multilink link add** command is not configured but the **dialer wait-for-carrier-time** command is, MLP will use the time value set with the **dialer wait-for-carrier-time** command. If neither command is configured, MLP uses a default value of 30 seconds.

This command is used with dynamic bandwidth (dial-on-demand) bundles.

## Examples

The following example sets the call timeout period to 45 seconds:

```
ppp timeout multilink link add 45
```

## Related Commands

| Command | Description |
|---|---|
| dialer wait-for-carrier-time (interface) | Specifies the length of time the interface waits for a carrier. |
| ppp timeout multilink link remove | Sets a timer that determines how long MLP waits to drop a link when traffic load goes below the configured load threshold. |

# ppp timeout multilink link remove

To set a timer that determines how long Multilink PPP (MLP) waits to drop a link when traffic load goes below the configured load threshold, use the **ppp timeout multilink link remove** command in interface configuration mode. To remove the value, use the **no** form of this command.

**ppp timeout multilink link remove** *wait-period*

**no ppp timeout multilink link remove**

## Syntax Description

| | |
|---|---|
| *wait-period* | Threshold wait period, in seconds, in the range from 1 to 65535 seconds. |

## Defaults

No default behavior or values.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Usage Guidelines

When traffic load goes below the threshold set with the **ppp multilink load-threshold** command, MLP waits for the time set with the **ppp timeout multilink link remove** command and, if the load still remains below that threshold, drops the link to reduce bandwidth.

MLP will reduce bandwidth but never remove the last link in a bundle. The complete severing of a connection is controlled by the idle timer value specified in the **dialer idle-timeout** command; however, the idle timer has no effect on when MLP will drop excess links in a bundle.

If the **ppp timeout multilink link remove** command is not configured but the **dialer wait-for-carrier-time** command is, MLP will use the time value set with the **dialer wait-for-carrier-time** command. If neither command is configured, MLP uses a default value of 30 seconds.

This command is used with dynamic bandwidth (dial-on-demand) bundles.

## Examples

The following example sets the low traffic load threshold wait period to 45 seconds:

```
ppp timeout multilink link remove 45
```

## Related Commands

| Command | Description |
|---|---|
| dialer fast-idle (interface) | Specifies the idle time before the line is disconnected. |
| dialer wait-for-carrier-time (interface) | Specifies the length of time the interface waits for a carrier. |
| ppp timeout multilink link add | Limits the amount of time for which MLP waits for a call to be established. |

# ppp timeout multilink lost-fragment

To set a timer that determines how long Multilink PPP (MLP) waits for an expected fragment to arrive before declaring it lost, use the **ppp timeout multilink lost-fragment** command in interface configuration mode. To reset the value, use the **no** form of this command.

**ppp timeout multilink lost-fragment** *wait-period*

**no ppp timeout multilink lost-fragment**

## Syntax Description

| | |
|---|---|
| *wait-period* | Wait period, in seconds, in the range from 1 to 255 seconds. |

## Defaults

1 second

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced. |

## Examples

The following example sets a 5-second wait period for receiving expected fragments before declaring the fragments lost:

```
ppp timeout multilink lost-fragment 5
```

## Related Commands

| Command | Description |
|---|---|
| **ppp link reorders** | Sets an advisory flag that indicates that the serial interface may receive packets in a different order than a peer system sent them. |

# ppp timeout ncp

To set a time limit for the successful negotiation of at least one network layer protocol after a PPP connection is established, use the **ppp timeout ncp** command in interface configuration mode. To reset the default condition, use the **no** form of this command.

**ppp timeout ncp** *time-limit*

**no ppp timeout ncp**

## Syntax Description

| | |
|---|---|
| *time-limit* | Maximum time, in seconds, PPP should wait for negotiation of a network layer protocol. If no network protocol is negotiated in the given time, the connection is disconnected. |

## Defaults

No time limit is imposed (**no ppp timeout ncp**).

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **ppp negotiation-timeout**. |
| 12.2 | This command was changed to **ppp timeout ncp**. The **ppp negotiation-timeout** command will be accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

The **ppp timeout ncp** command protects against the establishment of links that are physically up and carrying traffic at the link level, but are unusable for carrying data traffic due to failure to negotiate the capability to transport any network level data. This command is particularly useful for dialed connections, where it is usually undesirable to leave a telephone circuit active when it cannot carry network traffic. A Network Control Protocol (NCP) is considered open only when traffic is established in both directions.

## Examples

The following example sets the NCP timer to 8 seconds:

```
ppp timeout ncp 8
```

## Related Commands

| Command | Description |
|---|---|
| **absolute-timeout** | Sets the interval for closing user connections on a specific line or port. |
| **dialer idle-timeout (interface)** | Specifies the idle time before the line is disconnected. |

# ppp timeout retry

To set PPP timeout retry parameters, use the **ppp timeout retry** command in interface configuration mode. To reset the time value, use the **no** form of this command.

**ppp timeout retry** *response-time*

**no ppp timeout retry**

## Syntax Description

| | |
|---|---|
| *response-time* | Maximum time, in seconds, to wait for a response during PPP negotiation. |

## *Defaults*

2 seconds

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 11.3 | This command was introduced as **ppp restart-timer**. |
| 12.2 | This command was changed to **ppp timeout retry**. The **ppp restart-timer** command will be accepted by the command line interpreter through Cisco IOS Release 12.2. |

## Usage Guidelines

The **ppp timeout retry** command is useful for setting a maximum amount of time PPP should wait for a response to any control packet it sends.

## Examples

The following example sets the retry timer to 20 seconds:

```
ppp timeout retry 20
```

## Related Commands

| Command | Description |
|---|---|
| **ppp timeout authentication** | Sets PPP authentication timeout parameters. |
| **ppp timeout idle** | Sets PPP idle timeout parameters. |

# pptp flow-control receive-window

To specify how many packets the Point-to-Point Tunnel Protocol (PPTP) client can send before it must wait for acknowledgment from the tunnel server, use the **pptp flow-control receive-window** command in VPDN group configuration mode. To return to the default value of 16 packets, use the **no** form of this command.

**pptp flow-control receive-window** *packets*

**no pptp flow-control receive-window**

## Syntax Description

| | |
|---|---|
| *packets* | Number of packets the client can send before it has to wait for acknowledgment from the tunnel server. Valid values range from 1 to 64 packets. The default value is 16 packets. |

## Command Default

The PPTP client will send up to 16 packets before it must wait for acknowledgment.

## Command Modes

VPDN group configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(5)XE5 | This command was introduced |
| 12.1(5)T | This command was integrated into Cisco IOS Release 12.1(5)T. |

## Examples

The following example shows how to fine-tune PPTP by specifying the client can send 20 packets before it must wait for acknowledgment from the tunnel server:

```
vpdn enable
!
vpdn-group 1
! Default PPTP VPDN group
 accept-dialin
  protocol pptp
  virtual-template 1
!
 pptp flow-control receive-window 20
```

## Related Commands

| Command | Description |
|---|---|
| **encryption mppe** | Enables MPPE encryption on the virtual template. |
| **pptp flow-control static-rtt** | Specifies the tunnel server's timeout interval between sending a packet to the client and receiving a response. |
| **pptp tunnel echo** | Specifies the period of idle time on the tunnel that will trigger an echo message from the tunnel server to the client. |

# pptp flow-control static-rtt

To specify the timeout interval of the Point-to-Point Tunnel Protocol (PPTP) tunnel server between sending a packet to the client and receiving a response, use the **pptp flow-control static-rtt** command in VPDN group configuration mode. To return to the default value of 1500 milliseconds (ms), use the **no** form of this command.

**pptp flow-control static-rtt** *seconds*

**no pptp flow-control static-rtt**

## Syntax Description

| | |
|---|---|
| *seconds* | Timeout interval, in milliseconds (ms), that the tunnel server will wait between sending a packet to the client and receiving a response. Valid values range from 100 to 5000 ms. The default value is 1500 ms. |

## Command Default

The tunnel server will wait 1500 ms before timing out.

## Command Modes

VPDN group configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(5)XE5 | This command was introduced. |
| 12.1(5)T | This command was integrated into Cisco IOS Release 12.1(5)T. |

## Usage Guidelines

If the session times out, the tunnel server does not retry or resend the packet. Instead the flow control alarm is set off, and stateful mode is automatically switched to stateless.

## Examples

The following example shows how to fine-tune PPTP by increasing the timeout interval of the tunnel server from the default 1500 ms to 2000 ms:

```
vpdn enable
!
vpdn-group 1
! Default PPTP VPDN group
 accept-dialin
  protocol pptp
  virtual-template 1
!
 pptp flow-control static-rtt 2000
```

**Related Commands**

| Command | Description |
|---|---|
| **encryption mppe** | Enables MPPE encryption on the virtual template. |
| **pptp flow-control receive-window** | Specifies how many packets the client can send before it must wait for the acknowledgment from the tunnel server. |
| **pptp tunnel echo** | Specifies the period of idle time on the tunnel that will trigger an echo message from the tunnel server to the client. |

# pptp tunnel echo

To specify the period of idle time on the Point-to-Point Tunnel Protocol (PPTP) tunnel that will trigger an echo message from the tunnel server to the client, use the **pptp tunnel echo** command in VPDN group configuration mode. To return to the default value of 60 seconds, use the **no** form of this command.

**pptp tunnel echo** *seconds*

**no pptp tunnel echo**

## Syntax Description

| | |
|---|---|
| *seconds* | Echo packet interval, in seconds. Valid values range from 0 to 1000 seconds. The default interval is 60 seconds. |

## Command Default

The tunnel server will send an echo message after a 60-second idle interval.

## Command Modes

VPDN group configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(5)XE5 | This command was introduced. |
| 12.1(5)T | This command was integrated into Cisco IOS Release 12.1(5)T. |

## Usage Guidelines

Use the **pptp tunnel echo** command to set the idle time that the tunnel server will wait before sending an echo message to the client.

If the tunnel server does not receive a reply to the echo message within 20 seconds, it will tear down the tunnel. This 20-second interval is hard coded.

## Examples

The following example shows how to fine-tune PPTP by increasing the idle time interval of the tunnel server from the default 60 seconds to 90 seconds:

```
vpdn enable
!
vpdn-group 1
! Default PPTP VPDN group
 accept-dialin
  protocol pptp
  virtual-template 1
!
 pptp tunnel echo 90
```

## Related Commands

| Command | Description |
|---|---|
| **encryption mppe** | Enables MPPE encryption on the virtual template. |
| **pptp flow-control receive-window** | Specifies how many packets the client can send before it must wait for the acknowledgment from the tunnel server. |
| **pptp flow-control static-rtt** | Specifies the timeout interval of the tunnel server between sending a packet to the client and receiving a response. |