PPP Bandwidth Allocation Control Protocol Commands

This chapter describes the commands used to configure the Point-to-Point Protocol (PPP) Bandwidth Allocation Control Protocol (BACP) for dial-up solutions on your router.

For information about configuring BACP for dial-up solutions, see the *Dial Solutions Configuration Guide*.

For PPP configuration on a router or an access server, refer to the "Configuring Media-Independent PPP" chapter and the "Configuring Asynchronous PPP and SLIP" chapter in the *Dial Solutions Configuration Guide*. For PPP commands, see the "Media-Independent PPP Commands" and the "Asynchronous PPP and SLIP Commands" chapter in the *Dial Solutions Command Reference*.

For more information about BACP, see RFC 2125.

ppp bap call

To set PPP BACP call parameters, use the **ppp bap call** interface configuration command. 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 2 to 120 seconds. No default value is set.

Default

accept—Peers can initiate the addition of links to a multilink bundle.

The timer is disabled.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

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

Example

In the following example, a dialer interface is configured 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

You can use the master indexes or search online to find documentation of related commands.

ppp bap callback
ppp bap drop
ppp bap link types

ppp bap callback

To enable PPP BACP callback and set callback parameters, use the **ppp bap callback** interface configuration command. To remove the PPP BACP 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 2 to 120 seconds. Disabled by default.

Default

Callback is disabled and no callback parameters are set.

The timer is disabled.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

Example

In the following example, a BRI interface is configured for active mode BACP:

```
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

You can use the master indexes or search online to find documentation of related commands.

ppp bap call
ppp bap drop
ppp bap link types

ppp bap drop

To set parameters for removing links from a multilink bundle, use the **ppp bap drop** interface configuration command. 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 BACP 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.

Default

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 Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

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.

Example

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

```
ppp bap drop timer 60
```

Related Commands

You can use the master indexes or search online to find documentation of related commands.

ppp bap max

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** interface configuration command. 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.

Default

isdn

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

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. BACP dynamically determines which interfaces are applicable.

Example

In the following example, a dialer interface is configured for passive mode BACP 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

You can use the master indexes or search online to find documentation of related commands.

ppp bap call
ppp bap callback

ppp bap max

To set upper limits on the number of retransmissions for PPP BACP, use the **ppp bap max** interface configuration command. 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 1 to 3. The default is 1 dial attempt.
ind-retries *number*	Maximum number of retries of a call status indication message, in the range 1 to 10. The default is 3 indication retries.
req-retries *number*	Maximum number of retries for a particular request, in the range 1 to 5. The default is 3 request retries.
dialers *number*	Maximum number of free dialers logged, in the range 1 to 10. The default is 5 dialers.

Default

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

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

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 interface commands **dialer rotor** and **dialer priority** 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 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 also will limit the number of potential phone numbers which 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.

Example

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

You can use the master indexes or search online to find documentation of related commands.

dialer priority
dialer rotor
ppp bap drop
ppp bap monitor load
ppp bap timeout
show ppp bap group

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** interface configuration command. 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.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

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, BACP tries to drop a link.

The **no** form of the 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.

Example

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

```
no ppp bap monitor load
```

Related Commands

You can use the master indexes or search online to find documentation of related commands.

dialer-load threshold

ppp bap number

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

ppp bap number {**default** *phone-number* | **secondary** *phone-number*}
no ppp bap number [**default** | **secondary**]

Syntax Description

default *phone-number*	Primary (base) phone number for this interface, 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.

Default

No base number is provided.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

If a peer requests that a number be supplied and no PPP BACP 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 bundle.

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

Note During BACP negotiations between peers, the called party indicates the number to call for BACP 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 2157659876, and the **ppp bap number** command had the default number 2157659912, 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 BACP.

Examples

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
```

In the following example, a PRI with no BAP number defined accepts incoming dial attempts. The PRI interface has no base phone number defined, so each attempt to add a link would result in a delta of zero being provided to the calling peer. The calling peer should then dial the same number as it originally used to establish the bundle.

```
interface serial 0:23
 ip unnumbered Ethernet0
 encapsulation ppp
 dialer in-band
 dialer idle-timeout 300
 dialer-group 1
 no fair-queue
 no cdp enable
 ppp authentication chap
 ppp multilink bap
 ppp bap call accept
 ppp bap callback request
 ppp bap timeout pending 20
 ppp bap timeout response 2
 ppp bap max dial-attempts 2
 ppp bap monitor load
```

In the following example, a BRI interface with no BAP number defined, initiates outgoing dial attempts. The BRI interface has no base phone number defined, so the number that it uses to establish the bundle is that from the dialer map, and all phone delta operations are applied to that number.

```
interface bri 0
 ip unnumbered Ethernet0
 encapsulation ppp
 dialer in-band
 dialer idle-timeout 300
 dialer map ip 10.1.1.1 name bap_peer speed 56 19998884444
 dialer-group 1
 no fair-queue
 no cdp enable
 ppp authentication chap
 ppp multilink bap
 ppp bap call request
 ppp bap timeout pending 20
 ppp bap timeout response 2
 ppp bap max dial-attempts 2
 ppp bap monitor load
!
```

Related Commands

You can use the master indexes or search online to find documentation of related commands.

ppp bap call
ppp bap callback

ppp bap timeout

To specify nondefault timeout values for PPP BACP pending actions and responses, use the **ppp bap timeout** interface configuration command. 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 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 2 to 120 seconds. The default is 3 seconds.

Default

Enabled.

pending—20 seconds
response—3 seconds

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

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

Example

The following example configures BACP 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

You can use the master indexes or search online to find documentation of related commands.

ppp bap call
ppp bap callback
ppp bap drop
ppp bap max

ppp multilink

To enable Multilink PPP (MLP) on an interface and, optionally, to enable dynamic bandwidth allocation, use the **ppp multilink** interface configuration command. 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	Enforces mandatory negotiation of BACP for the multilink bundle. The multilink bundle is disconnected if BACP is not negotiated.

Defaults

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

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

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

This command applies only to interfaces that use PPP encapsulation.

PPP compression is allowed with MLP.

This command with the **bap** keyword must be used prior to 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.

When BACP negotiation is enabled by this command, the following values are used during negotiations to identify the protocols:

Protocol	Hexadecimal Value
BACP	0xC02B
BAP	0xC02D

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

When MLP is configured, the **dialer-load threshold 1** command no longer keeps a multilink bundle of any number of links connected indefinitely and the **dialer-load threshold 2** command no longer keeps a multilink bundle of 2 links connected indefinitely. If you want a multilink bundle to be connected indefinitely, you must set a very high idle timer.

Note that when using MLP, the first channel will negotiate the appropriate NCP layers (IPCP, IPXCP), but subsequent links will only negotiate LCP and MLP. NCP layers do not get negotiated on these links. It is normal to see these NCP layers in a closed state.

Related Commands

You can use the master indexes or search online to find documentation of related commands.

dialer-group
dialer idle-timeout
dialer load-threshold
encapsulation ppp
ppp authentication
ppp bap call
ppp bap timeout
ppp compress

show dialer map

To display configured dynamic and static dialer maps and dynamically created PPP BACP temporary static dialer maps, use the **show dialer map** EXEC command.

show dialer map

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

Sample Display

The following is sample output from the **show dialer map** command. The dialer maps are grouped by network address. When multiple dialer maps exist for the same network address, the dialer maps differ only by phone number. In this output, the dialer maps marked "BAP" are temporary dialer maps the PPP BACP creates when a peer calls from a different phone number than is configured or when a peer calls from a number that does not appear in an existing map. The temporary dialer maps allows PPP BACP to make outgoing calls to the peers.

```
bap_peer# show dialer map

Static dialer map ip 6.1.1.1 name peer_1 on Dialer1
Static dialer map ip 6.1.1.2 name peer_2 on Dialer1
BAP dialer map ip 6.1.1.2 name peer_2 on Dialer1
Dynamic dialer map ip 6.1.1.3 name peer_3 on Dialer1
BAP dialer map ip 6.1.1.3 name peer_3 on Dialer1
```

Table 121 describes the significant fields in this output.

Table 121 Show Dialer Map Field Descriptions

Field	Description
Static dialer map ip 6.1.1.1	This is a configured static dialer map to call the specified protocol address.
name peer_1	Name of the remote peer.
on Dialer1	The physical or logical dialer interface on which the static map is configured.
BAP dialer map ip 6.1.1.2	This is a temporary dialer map that was created by PPP BACP for the particular destination with a different phone number from that of any existing maps. It will be removed when the BACP group is removed or the last remaining map to that destination is removed.

Table 121 Show Dialer Map Field Descriptions (Continued)

Field	Description
Dynamic dialer map ip 6.1.1.3	Dialer map dynamically created when a peer called.
BAP dialer map ip 6.1.1.3 name peer_3	Temporary static dialer map created by PPP BACP when required. It will be removed when the BACP group is removed or when the dynamic dialer map disappears.

Related Commands

You can use the master indexes or search online to find documentation of related commands.

dialer map

show ppp bap

To display the configuration settings and run-time status for a multilink bundle, use the **show ppp bap** EXEC command.

show ppp bap {**group** [*name*] | **queues**}

Syntax Description

group [*name*]	Displays information about all or, optionally, a specific BACP bundle group.
queues	Displays information about the BACP queues.

Command Mode

Privileged EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3.

Sample Display

The following is sample output from the **show ppp bap group** command for the bundle group named *bap-peer*:

```
Group bap-peer (multilink), id 35, peer has precedence, state Idle
Master interface: Dialer1
Outgoing requests: Call, Link Drop
Incoming requests: Call, Callback, Link Drop
Original number dialed 5773926
Transmit queue size threshold is not set
Peer link addition dependent upon load
Timers (secs): Call not set, Callback not set, Link Drop not set,
               Response 30, Pending 20
Retries: Request 3, Dial 1, Indication no limit
Link removal after 3 link drop retries not set
```

Table 122 describes the significant fields in this display.

Table 122 Show PPP BAP Field Descriptions

Field	Description
Group bap-peer (multilink), id 35	Group name and internally assigned ID. “(multilink)” indicates the governing protocol.
peer has precedence	In BACP negotiations called “race condition scenarios” in the BACP specification, this peer is deemed to have precedence over the remote peer.
state Idle	Internal state.
Outgoing requests	Current requests configured for outbound negotiation.
Incoming requests	Current requests allowed inbound negotiation.

Table 122 Show PPP BAP Field Descriptions (Continued)

Field	Description
Peer link addition dependent upon load	Router is monitoring the load and subjecting requests to the load settings.
Timers (secs): Call not set, Callback not set, Link Drop not set, Response 30, Pending 20	Settings for specified timers.
Retries: Request 3, Dial 1, Indication no limit	Limits set on specified types of retransmissions.
Link removal after 3 link drop retries not set	The link will not be removed after no response to the link removal request because default behavior was not changed and the relevant link drop parameter was not set.

Related Commands

You can use the master indexes or search online to find documentation of related commands.

show ppp multilink

show ppp multilink

To display bundle information for the Multilink PPP bundles, use the **show ppp multilink** EXEC command.

show ppp multilink

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

Sample Display

The following is the output when no bundles are on a system:

```
Router# show ppp multilink

No active bundles
```

The following is sample output when a single Multilink PPP bundle (named *rudder*) is on a system:

```
Router# show ppp multilink

Bundle rudder, 3 members, first link is BRI0: B-channel 1
0 lost fragments, 8 reordered, 0 unassigned, sequence 0x1E/0x1E rcvd/sent
```

The following is sample output when two active bundles are on a system. Subsequent bundles would be displayed below the previous bundle.

```
Router# show ppp multilink

Bundle rudder, 3 members, first link is BRI0: B-Channel 1
  0 lost fragments, 8 reordered, 0 unassigned, sequence 0x1E/0x1E rcvd/sent
Bundle dallas, 4 members, first link is BRI2: B-Channel 1
  0 lost fragments, 28 reordered, 0 unassigned, sequence 0x12E/0x12E rcvd/sent
```

The following example shows output when a stack group has been created. On stack group member *systema*, Multilink PPP bundle *hansolo* has bundle interface *Virtual-Access4*. Two child interfaces are joined to this bundle interface. The first is a local PRI channel (serial 0:4), and the second is an interface from stack group member *systemb*.

```
systema# show ppp multilink

Bundle hansolo 2 members, Master link is Virtual-Access4
0 lost fragments, 0 reordered, 0 unassigned, 100/255 load
0 discarded,  0 lost received, sequence 40/66 rcvd/sent
members 2
 Serial0:4
 systemb:Virtual-Access6    (1.1.1.1)
```

The following is sample output when the PPP BACP is enabled for the multilink bundle:

```
systema# show ppp multilink

Bundle bap-peer, 1 member, Master link is Virtual-Access1
Bundle under BAP control
Dialer Interface is Dialer1
  0 lost fragments, 0 reordered, 0 unassigned, sequence 0x0/0x0 rcvd/sent
  0 discarded, 0 lost received, 1/255 load

Member links: 1
BRI0:1

Discriminators Local Remote
BRI0:1            24      1
```

Table 123 describes significant fields when PPP BACP is enabled.

Table 123 Show PPP Multilink Field Descriptions

Field	Description
Bundle	Configured name of the multilink bundle.
1 member	Number of interfaces in the group.
Master link is Virtual-Access1	Multilink bundle virtual interface.
Bundle under BAP control	Multilink bundle is controlled and bandwidth is allocated by BACP.
Dialer Interface is Dialer1	Name of the interface that dials the calls.
1/255 load	Load on the link in the range 1/255 to 255/255. (255/255 is a 100% load.)
Member links: 1	Number of child interfaces.
BRI0:1	Identity of the child interface. Link 1 is using physical interface BRI 0:1.
Discriminators Local Remote BRI0:1 24 1	LCP link discriminators, which are identifiers negotiated for each link in the bundle. This information is specific to BACP. BACP uses these discriminators to determine which link to drop during negotiations.