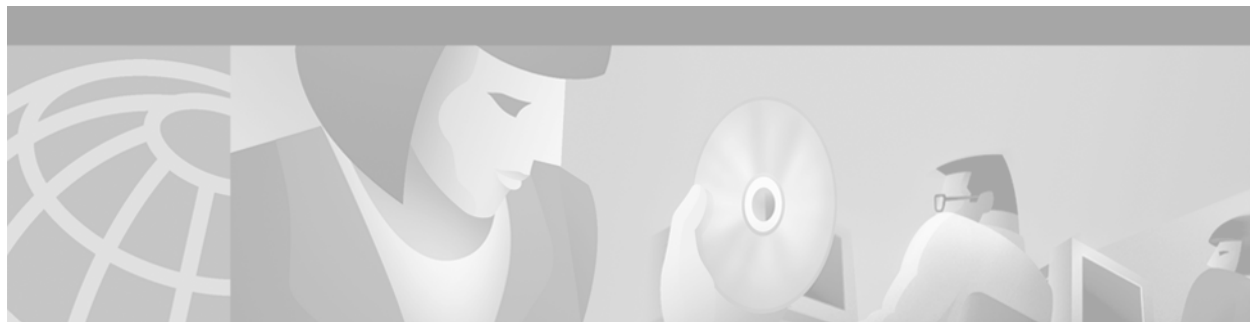




## Configuring BACP

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This chapter describes how to configure the Bandwidth Allocation Control Protocol (BACP), described in RFC 2125. It includes the following main sections:

- [BACP Overview](#)
- [How to Configure BACP](#)
- [Monitoring and Maintaining Interfaces Configured for BACP](#)
- [Troubleshooting BACP](#)
- [Configuration Examples for BACP](#)

BACP requires a system only to have the knowledge of its own phone numbers and link types. A system must be able to provide the phone numbers and link type to its peer to satisfy the call control mechanism. (Certain situations might not be able to satisfy this requirement; numbers might not be present because of security considerations.)

BACP is designed to operate in both the virtual interface environment and the dialer interface environment. It can operate over any physical interface that is Multilink PPP-capable and has a dial capability; at initial release, BACP supports ISDN and asynchronous serial interfaces.

The addition of any link to an existing multilink bundle is controlled by a Bandwidth Allocation Protocol (BAP) call or callback request message, and the removal of a link can be controlled by a link drop message.

To identify the hardware platform or software image information associated with a feature, use the Feature Navigator on Cisco.com to search for information about the feature or refer to the software release notes for a specific release. For more information, see the “Identifying Supported Platforms” section in the “Using Cisco IOS Software” chapter.

For a complete description of the PPP BACP commands in this chapter, refer to the [Cisco IOS Dial Technologies Command Reference](#), Release 12.2. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

# BACP Overview

The BACP provides Multilink PPP (MLP) peers with the ability to govern link utilization. Once peers have successfully negotiated BACP, they can use the BAP, which is a subset of BACP, to negotiate bandwidth allocation. BAP provides a set of rules governing dynamic bandwidth allocation through call control; a defined method for adding and removing links from a multilink bundle for Multilink PPP is used.

BACP provides the following benefits:

- Allows multilink implementations to interoperate by providing call control through the use of link types, speeds, and telephone numbers.
- Controls thrashing caused by links being brought up and removed in a short period of time.
- Ensures that both ends of the link are informed when links are added or removed from a multilink bundle.

For simplicity, the remaining text of this chapter makes no distinction between BACP and BAP; only BACP is mentioned.

## BACP Configuration Options

PPP BACP can be configured to operate in the following ways:

- **Passive mode (default)**—The system accepts incoming calls; the calls might request callback, addition of a link, or removal of a link from a multilink bundle. The system also monitors the multilink load by default.

Passive mode is for virtual template interfaces or for dialer interfaces.

- **Active mode**—The system initiates outbound calls, sets the parameters for outbound calls, and determines whether links should be added to or removed from a multilink bundle. The system also monitors the multilink load by default.

Active mode is for dialer interfaces, but not for virtual template interfaces. (If you attempt to configure active mode on a virtual template interface, no calls will be made.)

A virtual or dialer interface must be configured either to make call requests or to make callback requests, but it cannot be configured to do both.

Support of BACP on virtual interfaces in an Multichassis Multilink PPP (MMP) environment is restricted to incoming calls on the multilink group. Support of BACP for outgoing calls is provided by dialer interface configuration only.

BACP supports only ISDN and asynchronous serial interfaces.

Dialer support is provided only for legacy dial-on-demand routing (DDR) dialer configurations; BACP cannot be used in conjunction with the DDR dialer profiles feature.

BACP is configured on virtual template interfaces and physical interfaces that are multilink capable. For both the virtual template interfaces and the dialer interfaces, BACP requires MMP and bidirectional dialing to be working between the routers that will negotiate control and allocation of bandwidth for the multilink bundle.

# How to Configure BACP

Before you configure BACP on an interface, determine the following important information. The router might be unable to connect to a peer if this information is incorrect.

- Type of link (ISDN or analog) to be used. Link types must match on the local and remote ends of the link.
- Line speed needed to reach the remote peer. The speed configured for the local physical interface must be at least that of the link. The **bandwidth** command or the **dialer map** command with the **speed** keyword can be used.
- Local telephone number to be used for incoming PPP BACP calls, if it is different from a rotary group base number or if incoming PPP BACP calls should be directed to a specific number.

During negotiations with a peer, PPP BACP might respond with a telephone number *delta*, indicating that the peer should modify certain digits of the dialed phone number and dial again to reach the PPP BACP interface or to set up another link.

BACP can be configured on a virtual template interface or on a dialer interface (including dialer rotary groups and ISDN interfaces).

To configure BACP on a selected interface or interface template, perform the following tasks in the order listed:

- [Enabling BACP](#) (Required)  
Passive mode is in effect and the values of several parameters are set by default when PPP BACP is enabled. If you can accept *all* the passive mode parameters, do not continue with the tasks.
- [Modifying BACP Passive Mode Default Settings](#) (As required)  
or
- [Configuring Active Mode BACP](#) (As required)



## Note

You can configure one interface in passive mode and another in active mode so that one interface accepts incoming call requests and makes callback requests (passive mode), and the other interface makes call requests and accepts callback requests (active mode).

A dialer or virtual template interface should be configured to reflect the required dial capability of the interface. A dial-in pool (in passive mode) might have no requirement to dial out but might want remote users to add multiple links, with the remote user incurring the cost of the call. Similarly, a dial-out configuration (active mode) suggests that the router is a client, rather than a server, on that link. The active-mode user incurs the cost of additional links.

You might need to configure a base telephone number, if it is applicable to your dial-in environment. This number is one that remote users can dial to establish a connection. Otherwise, individual PPP BACP links might need numbers. Information is provided in the task lists for configuring passive mode or active mode PPP BACP. See the **ppp bap number** command options in the task lists.

You can also troubleshoot BACP configuration and operations and monitor interfaces configured for PPP BACP. For details, see the [“Troubleshooting BACP”](#) and [“Monitoring and Maintaining Interfaces Configured for BACP”](#) sections later in this chapter.

See the section [“Configuration Examples for BACP”](#) at the end of this chapter for examples of PPP BACP configuration.

## Enabling BACP

To enable PPP bandwidth allocation control and dynamic allocation of bandwidth, use one of the following commands in interface configuration mode:

| Command                                                    | Purpose                                                                                                                |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Router(config-if)# <b>ppp multilink bap</b>                | Enables PPP BACP bandwidth allocation negotiation.                                                                     |
| or<br>Router(config-if)# <b>ppp multilink bap required</b> | Enables PPP BACP bandwidth allocation negotiation and enforces mandatory negotiation of BACP for the multilink bundle. |

When PPP BACP is enabled, it is in passive mode by default and the following settings are in effect:

- Allows a peer to initiate link addition.
- Allows a peer to initiate link removal.
- Requests that a peer initiate link addition.
- Waits 20 seconds before timing out on pending actions.
- Waits 3 seconds before timing out on not receiving a response from a peer.
- Makes only one attempt to call a number.
- Makes up to three retries for sending a request.
- Searches for and logs up to five free dialers.
- Makes three attempts to send a call status indication.
- Adds only ISDN links to a multilink bundle.
- Monitors load.

The default settings will be in effect in the environment for which the **ppp multilink bap** command is entered:

- Virtual template interface, if that is where the command is entered.

When the command is entered in a virtual template interface, configuration applies to any virtual access interface that is created dynamically under Multilink PPP, the application that defines the template.

- Dialer interface, if that is where the command is entered.

See the section [“Basic BACP Configurations”](#) at the end of this chapter for an example of how to configure BACP.

## Modifying BACP Passive Mode Default Settings

To modify the default parameter values or to configure additional parameters in passive mode, use the following commands, as needed, in interface configuration mode for the interface or virtual template interface that is configured for PPP BACP:

| Command                                                                | Purpose                                                                                                                                                                                                                           |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Router(config-if)# <b>ppp bap timeout pending</b> <i>seconds</i>       | Modifies the timeout on pending actions.                                                                                                                                                                                          |
| Router(config-if)# <b>ppp bap timeout response</b> <i>seconds</i>      | Modifies the timeout on not receiving a response from a peer.                                                                                                                                                                     |
| Router(config-if)# <b>ppp bap max dial-attempts</b> <i>number</i>      | Modifies the number of attempts to call a number.                                                                                                                                                                                 |
| Router(config-if)# <b>ppp bap max ind-retries</b> <i>number</i>        | Modifies the number of times to send a call status indication.                                                                                                                                                                    |
| Router(config-if)# <b>ppp bap max req-retries</b> <i>number</i>        | Modifies the number of retries of a particular request.                                                                                                                                                                           |
| Router(config-if)# <b>ppp bap max dialers</b> <i>number</i>            | Modifies the maximum number of free dialers logged.                                                                                                                                                                               |
| Router(config-if)# <b>ppp bap link types analog</b>                    | Specifies that only analog links can be added to a multilink bundle.                                                                                                                                                              |
| or<br>Router(config-if)# <b>ppp bap link types isdn analog</b>         | Allows both ISDN and analog links to be added.                                                                                                                                                                                    |
| Router(config-if)# <b>ppp bap number default</b> <i>phone-number</i>   | For all DDR-capable interfaces in the group, specifies a primary telephone number for the peer to call for PPP BACP negotiation, if different from any base number defined on the dialer interface or virtual template interface. |
| Router(config-if)# <b>ppp bap number secondary</b> <i>phone-number</i> | For BRI interfaces on which a different number is provided for each B channel, specifies the secondary telephone number.                                                                                                          |
| Router(config-if)# <b>ppp bap drop timer</b> <i>seconds</i>            | Specifies a time to wait between outgoing link drop requests.                                                                                                                                                                     |
| Router(config-if)# <b>no ppp bap monitor load</b>                      | Disables the default monitoring of load and the validation of peer requests against load thresholds.                                                                                                                              |

See the section [“Passive Mode Dialer Rotary Group Members with One Dial-In Number”](#) later in this chapter for an example of how to configure passive mode parameters.

## Configuring Active Mode BACP

To configure active mode BACP, use the following commands in interface configuration mode for the dialer interface on which BACP was enabled. For your convenience, the commands that make BACP function in active mode are presented before the commands that change default parameters or add parameters.

| Command                                           | Purpose                                                                          |
|---------------------------------------------------|----------------------------------------------------------------------------------|
| Router(config-if)# <b>ppp bap call request</b>    | Enables the interface to initiate the addition of links to the multilink bundle. |
| Router(config-if)# <b>ppp bap callback accept</b> | Enables the interface to initiate the addition of links upon peer request.       |

| Command                                                                | Purpose                                                                                                                                                                                                                           |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Router(config-if)# <b>ppp bap drop after-retries</b>                   | Enables the interface to drop a link without negotiation after receiving no response to retries to send a drop request.                                                                                                           |
| Router(config-if)# <b>ppp bap call timer</b> <i>seconds</i>            | Sets the time to wait between outgoing call requests.                                                                                                                                                                             |
| Router(config-if)# <b>ppp bap timeout pending</b> <i>seconds</i>       | Modifies the timeout on pending actions.                                                                                                                                                                                          |
| Router(config-if)# <b>ppp bap timeout response</b> <i>seconds</i>      | Modifies the timeout on not receiving a response from a peer.                                                                                                                                                                     |
| Router(config-if)# <b>ppp bap max dial-attempts</b> <i>number</i>      | Modifies the number of attempts to call a number.                                                                                                                                                                                 |
| Router(config-if)# <b>ppp bap max ind-retries</b> <i>number</i>        | Modifies the number of times to send a call status indication.                                                                                                                                                                    |
| Router(config-if)# <b>ppp bap max req-retries</b> <i>number</i>        | Modifies the number of retries of a particular request.                                                                                                                                                                           |
| Router(config-if)# <b>ppp bap max dialers</b> <i>number</i>            | Modifies the maximum number of free dialers logged.                                                                                                                                                                               |
| Router(config-if)# <b>ppp bap link types analog</b>                    | Specifies that only analog links can be added to a multilink bundle.                                                                                                                                                              |
| or<br>Router(config-if)# <b>ppp bap link types isdn analog</b>         | Allows both ISDN and analog links to be added.                                                                                                                                                                                    |
| Router(config-if)# <b>ppp bap number default</b> <i>phone-number</i>   | For all DDR-capable interfaces in the group, specifies a primary telephone number for the peer to call for PPP BACP negotiation, if different from any base number defined on the dialer interface or virtual template interface. |
| Router(config-if)# <b>ppp bap number secondary</b> <i>phone-number</i> | For BRI interfaces on which a different number is provided for each B channel, specifies the secondary telephone number.                                                                                                          |

When BACP is enabled, multiple dialer maps to one destination are not needed when they differ only by number. That is, once the initial call has been made to create the bundle, further dialing attempts are realized through the BACP phone number negotiation.

Outgoing calls are supported through the use of dialer maps. However, when an initial incoming call creates a dynamic dialer map, the router can dial out if the peer supplies a phone number. This capability is achieved by the dynamic creation of static dialer maps for BACP. These temporary dialer maps can be displayed by using the **show dialer map** command. These temporary dialer maps last only as long as the BACP group lasts and are removed when the BACP group or the associated map is removed.

## Monitoring and Maintaining Interfaces Configured for BACP

To monitor interfaces configured for PPP BACP, use any of the following commands in EXEC mode:

| Command                                           | Purpose                                                                                                       |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Router> <b>show ppp bap group</b> [ <i>name</i> ] | Displays information about all PPP BACP multilink bundle groups or a specific, named multilink bundle group.  |
| Router> <b>show ppp bap queues</b>                | Displays information about the BACP queues.                                                                   |
| Router> <b>show ppp multilink</b>                 | Displays information about the dialer interface, the multilink bundle, and the group members.                 |
| Router> <b>show dialer</b>                        | Displays BACP numbers dialed and the reasons for the calls.                                                   |
| Router> <b>show dialer map</b>                    | Displays configured dynamic and static dialer maps and dynamically created BACP temporary static dialer maps. |

# Troubleshooting BACP

To troubleshoot the BACP configuration and operation, use the following **debug** commands:

| Command                                                    | Purpose                                                                             |
|------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Router> <b>debug ppp bap</b> [error   event   negotiation] | Displays BACP errors, protocol actions, and negotiation events and transitions.     |
| Router> <b>debug ppp multilink events</b>                  | Displays information about events affecting multilink bundles established for BACP. |

## Configuration Examples for BACP

The following sections provide BACP configuration examples:

- [Basic BACP Configurations](#)
- [Dialer Rotary Group with Different Dial-In Numbers](#)
- [Passive Mode Dialer Rotary Group Members with One Dial-In Number](#)
- [PRI Interface with No Defined PPP BACP Number](#)
- [BRI Interface with No Defined BACP Number](#)

### Basic BACP Configurations

The following example configures an ISDN BRI interface for BACP to make outgoing calls and prevent the peer from negotiating link drops:

```
interface bri 0
 ip unnumbered ethernet 0
 dialer load-threshold 10 either
 dialer map ip 172.21.13.101 name bap-peer 12345668899
 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
```

The following example configures a dialer rotary group to accept incoming calls:

```
interface async 1
 no ip address
 encapsulation ppp
 dialer rotary-group 1
 ppp bap number default 5663456
!
! Set the bandwidth to suit the modem/line speed on the remote side.
interface bri 0
 no ip address
 bandwidth 38400
 encapsulation ppp
```

```

dialer rotary-group 1
ppp bap number default 5663457
!
interface bri 1
no ip address
encapsulation ppp
dialer rotary-group 1
ppp bap number default 5663458
!
interface dialer1
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

```

The following example configures a virtual template interface to use BACP in passive mode:

```

multilink virtual-template 1
!
interface virtual-template 1
ip unnumbered ethernet 0
encapsulation ppp
ppp multilink bap
ppp authentication chap callin

```

The bundle is created from any MMP-capable interface.

The following example creates a bundle on a BRI interface:

```

interface bri 0
no ip address
encapsulation ppp
ppp multilink
ppp bap number default 4000
ppp bap number secondary 4001

```

## Dialer Rotary Group with Different Dial-In Numbers

The following example configures a dialer rotary group that has four members, each with a different number, and that accepts incoming dial attempts. The dialer interface does not have a base phone number; the interface used to establish the first link in the multilink bundle will provide the appropriate number from its configuration.

```

interface bri 0
no ip address
encapsulation ppp
dialer rotary-group 1
no fair-queue
no cdp enable
ppp bap number default 6666666
!
interface bri 1
no ip address
encapsulation ppp
dialer rotary-group 1
no fair-queue
no cdp enable
ppp bap number default 6666667
!

```



```
interface bri 2
  no ip address
  encapsulation ppp
dialer rotary-group 1
  no fair-queue
  no cdp enable
  ppp bap number default 6666668
!
interface bri 3
  no ip address
  encapsulation ppp
dialer rotary-group 1
  no fair-queue
  no cdp enable
  ppp bap number default 6666669
!
interface dialer 1
  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
```

## Passive Mode Dialer Rotary Group Members with One Dial-In Number

The following example, a dialer rotary group with two members each with the same number, accepts incoming dial attempts. The dialer interface has a base phone number because each of its member interfaces is in a hunt group and the same number can be used to access each individual interface.

```
interface bri 0
  no ip address
  encapsulation ppp
dialer rotary-group 1
  no fair-queue
  no cdp enable
!
interface bri 1
  no ip address
  encapsulation ppp
dialer rotary-group 1
  no fair-queue
  no cdp enable
!
interface dialer 1
  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
ppp bap number default 6666666
```

## PRI Interface with No Defined PPP BACP Number

In the following example, a PRI interface has no BACP number defined and accepts incoming dial attempts (passive mode). 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. To establish the bundle, the peer should then dial the same number as it originally used.

```
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
```

## BRI Interface with No Defined BACP Number

In the following example, the BRI interface has no base phone number defined. 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
```