ZebOS-XP®
Network Platform

Version 1.4
Extended Performance

Bidirectional Forwarding Detection
Command Reference

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Contents

Preface

This document describes the ZebOS-XP commands for Bidirectional Forwarding Detection (BFD).

Audience

This document is intended for network administrators and other engineering professionals who configure and manage BFD.

Conventions

Table P-1 shows the conventions used in this guide.

Table P-1: Conventions

Convention	Description
Italics	Emphasized terms; titles of books
Note:	Special instructions, suggestions, or warnings
`monospaced type`	Code elements such as commands, functions, parameters, files, and directories

Contents

This document contains these chapters:

- Chapter 1, *Command Line Interface*
- Chapter 2, *Bidirectional Forwarding Commands*
- Chapter 3, *Protocol Commands for BFD*
- Chapter 4, *BFD Static Route Commands*

Related Documents

The following guides are related to this document:

- *Bidirectional Forwarding Detection Developer Guide*
- *Bidirectional Forwarding Detection Configuration Guide*
- *Installation Guide*

Note: All ZebOS-XP technical manuals are available to licensed customers at http://www.ipinfusion.com/support/document_list.

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CHAPTER 1 Command Line Interface

This chapter introduces the ZebOS-XP Command Line Interface (CLI) and how to use its features.

Overview

You use the CLI to configure, monitor, and maintain ZebOS-XP devices. The CLI is text-based and each command is usually associated with a specific task.

You can give the commands described in this manual locally from the console of a device running ZebOS-XP or remotely from a terminal emulator such as `putty` or `xterm`. You can also use the commands in scripts to automate configuration tasks.

Starting the Command Line Interface

You must start daemons as described in this section before you can use the CLI. The general steps are listed below. For details about the ZebOS-XP daemons, see the *Installation Guide.*

1. Start your terminal emulator and connect to the device or go to the console of the device running ZebOS-XP.
2. Connect to the directory where you installed the ZebOS-XP executables.
3. Start the Network Services Module (NSM).
   ```
   # ./nsm -d
   ```
4. Start the protocol module daemons that your organization uses, such as `mstpd`, `ospf6d`, or `ripd`.
   ```
   # ./mstpd -d
   ```
5. Start the Integrated Management Interface (IMI) daemon.
   ```
   # ./imi -d
   ```
6. Start the IMI shell.
   ```
   # ./imish
   ```
   Note: Your organization may use a ZebOS-XP build that does not include `imish`. If that is the case, you must connect to a port on which a protocol daemon is listening. For details, see the *Installation Guide.*

You can now begin using the CLI.

Command Line Interface Help

You access the CLI help by entering a full or partial command string and a question mark “?”. The CLI displays the command keywords or parameters along with a short description. For example, at the CLI command prompt, type:

```
> show ?
```

The CLI displays this keyword list with short descriptions for each keyword:

```
show ?
  application-priority            Application Priority
```

```
  arp                             Internet Protocol (IP)
  bfd                             Bidirectional Forwarding Detection (BFD)
  bgp                             Border Gateway Protocol (BGP)
  bi-lsp                          Bi-directional lsp status and configuration
  bridge                          Bridge group commands
  ce-vlan                         COS Preservation for Customer Edge VLAN
  class-map                       Class map entry
  cli                             Show CLI tree of current mode
  clns                            Connectionless-Mode Network Service (CLNS)
  control-adjacency               Control Adjacency status and configuration
  control-channel                 Control Channel status and configuration
  cspf                            CSPF Information
  customer                        Display Customer spanning-tree
  cvlan                           Display CVLAN information
  debugging                       Debugging functions (see also 'undebug')
  dot1x                           IEEE 802.1X Port-Based Access Control
  etherchannel                    LACP etherchannel
  ethernet                        Layer-2
...
```

If you type the ? in the middle of a keyword, the CLI displays help for that keyword only.

```
> show de?
debugging  Debugging functions (see also 'undebug')
```

If you type the ? in the middle of a keyword, but the incomplete keyword matches several other keywords, ZebOS-XP displays help for all matching keywords.

```
> show i? (CLI does not display the question mark).
interface  Interface status and configuration
ip         IP information
isis       ISIS information
```

Command Completion

The CLI can complete the spelling of a command or a parameter. Begin typing the command or parameter and then press the tab key. For example, at the CLI command prompt type `sh`:

```
> sh
```

Press the tab key. The CLI displays:

```
> show
```

If the spelling of a command or parameter is ambiguous, the CLI displays the choices that match the abbreviation. Type `show i` and press the tab key. The CLI displays:

```
> show i
  interface  ip         ipv6       isis
> show i
```

The CLI displays the `interface` and `ip` keywords. Type `n` to select `interface` and press the tab key. The CLI displays:

```
> show in
> show interface
```

Type ? and the CLI displays the list of parameters for the `show interface` command.

```
> show interface
  IFNAME  Interface name
  |       Output modifiers
```

```
>       Output redirection
<cr>
```

The CLI displays the only parameter associated with this command, the `IFNAME` parameter.

Command Abbreviations

The CLI accepts abbreviations that uniquely identify a keyword in commands. For example:

```
> sh in eth0
```

is an abbreviation for:

```
> show interface eth0
```

Command Line Errors

Any unknown spelling causes the CLI to display the error `Unrecognized command` in response to the ?. The CLI displays the command again as last entered.

```
> show dd?
% Unrecognized command
> show dd
```

When you press the Enter key after typing an invalid command, the CLI displays:

```
(config)#router ospf here
                          ^
% Invalid input detected at '^' marker.
```

where the ^ points to the first character in error in the command.

If a command is incomplete, the CLI displays the following message:

```
> show
% Incomplete command.
```

Some commands are too long for the display line and can wrap mid-parameter or mid-keyword, as shown below. This does *not* cause an error and the command performs as expected:

```
area 10.10.0.18 virtual-link 10.10.0.19 authent
ication-key 57393
```

Command Negation

Many commands have a `no` form that resets a feature to its default value or disables the feature. For example:

- The `ip address` command assigns an IPv4 address to an interface
- The `no ip address` command removes an IPv4 address from an interface

Syntax Conventions

Table 1-1 describes the conventions used to represent command syntax in this reference.

Table 1-1: Syntax conventions

Convention	Description	Example
`monospaced font`	Command strings entered on a command line	`show bfd`
`lowercase`	Keywords that you enter exactly as shown in the command syntax.	`show bfd`
`UPPERCASE`	See Variable Placeholders	`IFNAME`
`()`	Optional parameters, from which you must select one. Vertical bars delimit the selections. Do not enter the parentheses or vertical bars as part of the command.	`(A.B.C.D|<0-4294967295>)`
`()`	Optional parameters, from which you select one or none. Vertical bars delimit the selections. Do not enter the parentheses or vertical bars as part of the command.	`(A.B.C.D|<0-4294967295>|)`
`()`	Optional parameter which you can specify or omit. Do not enter the parentheses or vertical bar as part of the command.	`(IFNAME|)`
`{}`	Optional parameters, from which you must select one or more. Vertical bars delimit the selections. Do not enter the braces or vertical bars as part of the command.	`{intra-area <1-255>|inter-area <1-255>|external <1-255>}`
`[]`	Optional parameters, from which you select zero or more. Vertical bars delimit the selections. Do not enter the brackets or vertical bars as part of the command. A '?' before a parameter in square brackets limits that parameter to one occurrence in a command string.	`[<1-65535>|AA:NN|internet|local-AS|no-advertise|no-export]`
`.`	Repeatable parameter. The parameter that follows a period can be repeated more than once. Do not enter the period as part of the command.	`set as-path prepend .<1-65535>`

Variable Placeholders

Table 1-2 shows the tokens used in command syntax use to represent variables for which you supply a value.

Table 1-2: Variable placeholders

Token	Description
WORD	A contiguous text string (excluding spaces)
LINE	A text string, including spaces; no other parameters can follow this parameter
IFNAME	Interface name whose format varies depending on the platform; examples are: eth0, Ethernet0, ethernet0, xe0
A.B.C.D	IPv4 address
A.B.C.D/M	IPv4 address and mask/prefix
X:X::X:X	IPv6 address
X:X::X:X/M	IPv6 address and mask/prefix
HH:MM:SS	Time format
AA:NN	BGP community value
XX:XX:XX:XX:XX:XX	MAC address
<1-5> <1-65535> <0-2147483647> <0-4294967295>	Numeric range

Command Description Format

Table 1-3 explains the sections used to describe each command in this reference.

Table 1-3: Command descriptions

Section	Description
Command Name	The name of the command, followed by what the command does and when should it be used
Command Syntax	The syntax of the command
Parameters	Parameters and options for the command
Default	The state before the command is executed
Command Mode	The mode in which the command runs; see Command Modes
Example	An example of the command being executed

Keyboard Operations

Table 1-4 lists the operations you can perform from the keyboard.

Table 1-4: Keyboard operations

Key combination	Operation
Left arrow or Ctrl+b	Moves one character to the left. When a command extends beyond a single line, you can press left arrow or Ctrl+b repeatedly to scroll toward the beginning of the line, or you can press Ctrl+a to go directly to the beginning of the line.
Right arrow or Ctrl-f	Moves one character to the right. When a command extends beyond a single line, you can press right arrow or Ctrl+f repeatedly to scroll toward the end of the line, or you can press Ctrl+e to go directly to the end of the line.
Esc, b	Moves back one word
Esc, f	Moves forward one word
Ctrl+e	Moves to end of the line
Ctrl+a	Moves to the beginning of the line
Ctrl+u	Deletes the line
Ctrl+w	Deletes from the cursor to the previous whitespace
Alt+d	Deletes the current word
Ctrl+k	Deletes from the cursor to the end of line
Ctrl+y	Pastes text previously deleted with Ctrl+k, Alt+d, Ctrl+w, or Ctrl+u at the cursor

Table 1-4: Keyboard operations (Continued)

Key combination	Operation
Ctrl+t	Transposes the current character with the previous character
Ctrl+c	Ignores the current line and redisplays the command prompt
Ctrl+z	Ends configuration mode and returns to exec mode
Ctrl+l	Clears the screen
Up Arrow or Ctrl+p	Scroll backward through command history
Down Arrow or Ctrl+n	Scroll forward through command history

Show Command Modifiers

You can use two tokens to modify the output of a `show` command. Enter a question mark to display these tokens:

```
# show users ?
  | Output modifiers
  > Output redirection
```

You can type the | (vertical bar character) to use output modifiers. For example:

```
> show rsvp | ?
  begin     Begin with the line that matches
  exclude   Exclude lines that match
  include   Include lines that match
  redirect  Redirect output
```

Begin Modifier

The `begin` modifier displays the output beginning with the first line that contains the input string (everything typed after the `begin` keyword). For example:

```
# show run | begin eth1
...skipping
interface eth1
 ipv6 address fe80::204:75ff:fee6:5393/64
!
interface eth2
 ipv6 address fe80::20d:56ff:fe96:725a/64
!
line con 0
 login
!
end
```

You can specify a regular expression after the `begin` keyword, This example begins the output at a line with either “eth3” or “eth4”:

```
# show run | begin eth[3-4]

...skipping
interface eth3
```

```
 shutdown
!
interface eth4
 shutdown
!
interface svlan0.1
 no shutdown
!
route-map myroute permit 3
!
route-map mymap1 permit 10
!
route-map rmap1 permit 3
!
line con 0
 login
line vty 0 4
 login
!
end
```

Include Modifier

The `include` modifier includes only those lines of output that contain the input string. In the output below, all lines containing the word “input” are included:

```
# show interface eth1 | include input
    input packets 80434552, bytes 2147483647, dropped 0, multicast packets 0
    input errors 0, length 0, overrun 0, CRC 0, frame 0, fifo 1, missed 0
```

You can specify a regular expression after the `include` keyword. This examples includes all lines with “input” or “output”:

```
#show int eth0 | include (in|out)put
    input packets 597058, bytes 338081476, dropped 0, multicast packets 0
    input errors 0, length 0, overrun 0, CRC 0, frame 0, fifo 0, missed 0
    output packets 613147, bytes 126055987, dropped 0
    output errors 0, aborted 0, carrier 0, fifo 0, heartbeat 0, window 0
```

Exclude Modifier

The `exclude` modifier excludes all lines of output that contain the input string. In the following output example, all lines containing the word “input” are excluded:

```
# show interface eth1 | exclude input
Interface eth1
  Scope: both
  Hardware is Ethernet, address is 0004.75e6.5393
  index 3 metric 1 mtu 1500 <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  Administrative Group(s): None
  DSTE Bandwidth Constraint Mode is MAM
  inet6 fe80::204:75ff:fee6:5393/64
    output packets 4438, bytes 394940, dropped 0
    output errors 0, aborted 0, carrier 0, fifo 0, heartbeat 0, window 0
    collisions 0
```

You can specify a regular expression after the `exclude` keyword. This example excludes lines with “output” or “input”:


```
# show interface eth0 | exclude (in|out)put
Interface eth0
  Scope: both
  Hardware is Ethernet  Current HW addr: 001b.2139.6c4a
  Physical:001b.2139.6c4a  Logical:(not set)
  index 2 metric 1 mtu 1500 duplex-full arp ageing timeout 3000
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  Bandwidth 100m
  DHCP client is disabled.
  inet 10.1.2.173/24 broadcast 10.1.2.255
  VRRP Master of :  VRRP is not configured on this interface.
  inet6 fe80::21b:21ff:fe39:6c4a/64
    collisions 0
```

Redirect Modifier

The `redirect` modifier writes the output into a file. The output is not displayed.

```
# show history | redirect /var/frame.txt
```

The output redirection token (>) does the same thing:

```
# show history >/var/frame.txt
```

Command Modes

Commands are grouped into modes arranged in a hierarchy. Each mode has its own set of commands. Table 1-5 lists the command modes common to all protocols.

Table 1-5: Common command modes

Name	Description
Executive mode	Also called *view* mode, this is the first mode to appear after you start the CLI. It is a base mode from where you can perform basic commands such as `show`, `exit`, `quit`, `help`, `list`, and `enable`.
Privileged executive mode	Also called *enable* mode, in this mode you can run additional basic commands such as `debug`, `write`, and `show`.
Configure mode	Also called *configure terminal* mode, in this mode you can run configuration commands and go into other modes such as interface, router, route map, key chain, and address family.
Interface mode	In this mode you can configure protocol-specific settings for a particular interface. Any setting you configure in this mode overrides a setting configured in router mode.
Router mode	This mode is used to configure router-specific settings for a protocol such as RIP or OSPF.

Command Mode Tree

The diagram below shows the common command mode hierarchy.

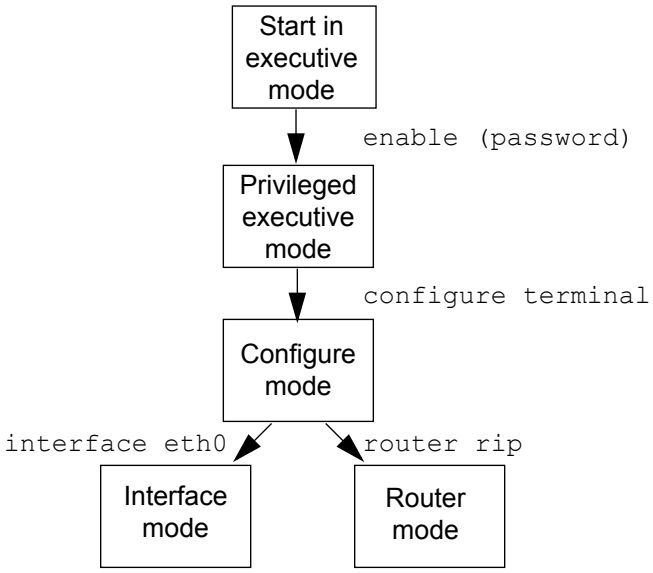

Figure 1-1: Common command modes

To change modes:

1. Enter privileged executive mode by entering `enable` in Executive mode.
2. Enter configure mode by entering `configure terminal` in Privileged Executive mode.

The example below shows starting `imish` and then moving from executive mode to privileged executive mode to configure mode and finally to router mode:

```
# ./imish
> enable mypassword
# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
(config)# router rip
(config-router)#
```

Note: Each protocol can have modes in addition to the common command modes. See the command reference for the respective protocol for details.

Debug Command

Whether the settings you make for a `debug` command persist between sessions depends on the mode where you make the settings:

- When you make settings for a `debug` command in executive mode, the configuration is valid for the current session only and is not saved in the `ZebOS.conf` file.
- When you make settings for a `debug` command in configuration mode, the configuration is retained and saved in `ZebOS.conf` and used even after the session restarts.

CHAPTER 2 Bidirectional Forwarding Commands

This chapter includes the commands used to configure and manage the BFD base module in a network. It includes the following commands:

bfd auth type

Use this command to enable BFD authentication on an interface that has either an IPv4 or an IPv6 BFD session. The configured key-chain option identifies the key-chain name. A key-chain consists of a configured key-id and authentication string, which can be configured under key-chain mode (refer to key chain on page 35 for more information). BFD authentication uses the active key-id when there are multiple key-ids under a key-chain.
Use the `no` form of the command to disable BFD authentication.

Command Syntax

```
bfd auth type (simple | keyed-md5 | meticulous-keyed-md5 | keyed-sha1 | meticulous-
  keyed-sha1) (key-id <0-255> key LINE | key-chain LINE)
no bfd auth
```

Parameters

`simple`	Specify a simple authentication type.
`keyed-md5`	Specify a keyed message digest authentication type.
`meticulous-keyed-md5`	Specify a meticulous keyed message digest authentication type.
`keyed-sha1`	Specify a keyed secure hashing algorithm authentication type.
`meticulous-keyed-sha1`	Specify an authentication key meticulous keyed secure hashing algorithm authentication.
`key-id`	Indicate the `key-id` keyword.
`<0-255>`	Specify the key ID value.
`key`	Indicate the `key` keyword.
`LINE`	Specify the authentication key name.
`key-chain`	Indicate the `key-chain` keyword.
`LINE`	Specify the authentication key-chain name.

Command Mode

Interface mode

Example

Do the following to configure a single-key support:

```
(config)#interface eth1
(config-if)#bfd auth type simple key-id 14 key ipi-zebos
```

Do the following to configure a multiple-key support:

```
(config)#interface eth1
(config-if)#bfd auth type simple key-chain bfd-auth
(config-if)#exit
(config)#key chain bfd-chain
(config-keychain)#key 14
(config-keychain-key)#key-string ipi-zebos
```

bfd disable

Use this command to disable all the BFD sessions on this interface.

Command Syntax

```
bfd disable
```

Parameters

None

Command Mode

Interface mode

Example

```
#configure terminal
(config)#interface eth1
(config-if)#bfd disable
```

bfd echo

Use this command to set BFD sessions to echo mode.

Use the `no` form of the command to return a BFD session to its default mode.

Command Syntax

```
bfd echo
no bfd echo
```

Parameters

None

Command Mode

Configure mode

Example

```
#configure terminal
(config)#bfd echo
```

bfd echo interval

Use this command to set the BFD echo interval.

Use the `no` form of this command to reset the echo interval to its default value.

Command Syntax

```
bfd echo interval <1-4294967>
no bfd echo interval <1-4294967>
```

Parameter

`<1-4294967>`	Transmit interval in milliseconds.

Command Mode

Interface mode

Example

The following command sets the BFD echo with no values.

```
#configure terminal
(config)#interface eth1
(config-if)#bfd echo interval 234
```

bfd gtsm

Use this command to enable or disable BFD GTSM (Generalized TTL Security Mechanism) protection.

Command Syntax

```
bfd gtsm (enable | disable)
```

Parameters

`disable`	Disable GTSM protection.
`enable`	Enable GTSM protection.

Command Mode

Configure mode

Examples

```
#configure terminal
(config)#bfd gtsm enable
```

bfd gtsm ttl

Use this command sets a BFD GTSM TTL (time to live) value.

Command Syntax

```
bfd gtsm ttl <1-255>
```

Parameters

<1-255>	Allowed range for TTL

Command Mode

Configure mode

Examples

```
#configure terminal
(config)#bfd gtsm ttl 123
```

bfd interval

Use this command to configure BFD transmit and receive intervals, and the value of Hello Multiplier.

Use the `no` form of the command to set the intervals and multiplier back to their default values.

Command Syntax

```
bfd interval <50-999> minrx <50-999> multiplier <3-50>
no bfd interval <50-999> minrx <50-999> multiplier <3-50>
```

Parameters

`<50-999>`	Transmit interval in milliseconds.
`minrx`	Indicate the minrx parameter.
`<50-999>`	Specify the actual reception interval in milliseconds.
`multiplier`	Indicate the multiplier parameter.
`<3-50>`	Specify the actual hello multiplier value.

Command Mode

Interface mode

Default

Multiplier value is 3

Example

```
#configure terminal
(config)#interface eth1
(config-if)#bfd interval 100 minrx 100 multiplier 5
(config-if)#
```

bfd multihop-peer

Use this command to enable authentication over either a multihop IPv4 or IPv6 session

Use the `no` form of the command to disable BFD authentication.

Command Syntax

```
bfd multihop-peer (A.B.C.D | X:X::X:X) auth type (simple | keyed-md5 | meticulous-keyed-md5 | keyed-sha1 | meticulous-keyed-sha1) key-id <0-255> key LINE | key-chain LINE)
no bfd multihop-peer (A.B.C.D | X:X::X:X) auth type (simple | keyed-md5 | meticulous-keyed-md5 | keyed-sha1 | meticulous-keyed-sha1) key-id <0-255> key LINE | key-chain LINE)
```

Parameters

`A.B.C.D`	Specify an IPv4 address.
`X:X::X:X`	Specify an IPv6 address.
`auth type`	Specify an authentication type.
`simple`	Specify a simple authentication type.
`keyed-md5`	Specify a keyed message digest authentication type.
`meticulous-keyed-md5`	Specify a meticulous keyed message digest authentication type.
`keyed-sha1`	Specify a keyed secure hashing algorithm authentication type.
`meticulous-keyed-sha1`	Specify an authentication key Meticulous Keyed Secure hashing algorithm authentication type.
`key-id`	Indicate the `key-id` keyword.
`<0-255>`	Specify the key ID value.
`key`	Indicate the `key` keyword.
`LINE`	Specify the authentication key name.
`key-chain`	Indicate the `key-chain` keyword.
`LINE`	Specify the authentication key-chain name.

Command Mode

Configure mode

Example

Do the following to configure a single-key support:

```
#configure terminal
(config)#bfd multihop-peer 123.12.1.2 auth-type simple key-id 14 key ipi-zebos
```

Do the following to configure a multiple-key support:

```
#configure terminal
(config)#bfd multihop-peer 123.12.1.2 auth-type key-chain bfd-auth
(config)#key chain bfd-chain
(config-keychain)#key 14
(config-keychain-key)#key-string ipi-zebos
```

bfd multihop-peer A.B.C.D

Use this command to configure IPv4 BFD multihop peer timer values.

Use the `no` form of the command to reset the IPv4 multihop peer timer value.

Command Syntax

```
bfd multihop-peer A.B.C.D interval <50-999> minrx <50-999> multiplier <3-50>
no bfd multihop-peer A.B.C.D interval <50-999> minrx <50-999> multiplier <3-50>
```

Parameters

`interval`	Indicate the interval parameter.
`<50-999>`	Specify the actual transmit interval in milliseconds.
`minrx`	Indicate the minrx parameter.
`<50-999>`	Specify the actual reception interval in milliseconds.
`multiplier`	Indicate the multiplier parameter.
`<3-50>`	Specify the actual hello multiplier value.

Command Mode

Configure mode

Default

Multiplier value is 3

Example

```
#configure terminal
(config)#bfd multihop-peer 10.1.1.67 interval 100 minrx 100 multiplier 3
(config)#
```

bfd multihop-peer X:X::X:X

Use this command to configure an IPv6 BFD multihop peer timer values.

Use the `no` form of the command to reset the IPv6 multihop peer timer values.

Command Syntax

```
bfd multihop-peer X:X::X:X interval <50-999> minrx <50-999> multiplier <3-50>
no bfd multihop-peer X:X::X:X interval <50-999> minrx <50-999> multiplier <3-50>
```

Parameters

`interval`	Indicate the interval parameter.
`<50-999>`	Specify the actual transmit interval in milliseconds.
`minrx`	Indicate the minrx parameter.
`<50-999>`	Specify the actual reception interval in milliseconds.
`multiplier`	Indicate the multiplier parameter.
`<3-50>`	Specify the actual hello multiplier value.

Command Mode

Configure mode

Default

Default multiplier value is 3

Example

```
#configure terminal
(config)#bfd multihop-peer 10.1.1.1 interval 100 minrx 100 multiplier 3
```

bfd notification

Use this command to enable or disable BFD notification.

Command Syntax

```
bfd notification (enable | disable)
```

Parameters

`disable`	Disable BFD notification.
`enable`	Enable BFD notification.

Command Mode

Configure mode

Examples

```
#configure terminal
(config)#bfd notification enable

(config)#bfd notification disable
```

bfd session

Use this command to configure a BFD session.

You can configure a BFD session without any existing BFD application (such as OSPF or static routes) using this command. This can be useful in scenarios where the peer has a BFD application and requires the device under test (DUT) to sustain a BFD session.

Use the no parameter with this command to remove this BFD session.

Command Syntax

IPv4 without MPLS-TP:

```
bfd session A.B.C.D A.B.C.D (multihop|) (demand-mode|) (non-persistent|)
  (admindown|)
no bfd session A.B.C.D A.B.C.D (multihop|) (demand-mode|) (non-persistent|)
  (admindown|)
```

IPv6 without MPLS-TP:

```
bfd session X:X::X:X X:X::X:X (multihop|) (demand-mode|) (non-persistent|)
  (admindown|)
no bfd session X:X::X:X X:X::X:X (multihop|) (demand-mode|) (non-persistent|)
  (admin-down|)
```

IPv4 and IPv6 with MPLS-TP:

```
bfd session (data-link-oam (mac-address MAC|) | X:X::X:X X:X::X:X (multihop|)
(demand-mode|) (non-persistent|) (admin-down|))
no bfd session (data-link-oam (mac-address MAC|) | X:X::X:X X:X::X:X (multihop|)
(demand-mode|) (non-persistent|) (admin-down|))
```

Syntax

A.B.C.D	Source IPv4 address.
A.B.C.D	Destination IPv4 address.
X:X::X:X	Source IPv6 address.
X:X::X:X	Destination IPv6 address.
non-persistent	Not a persistent session.
admin-down	Session admin down.
demand-mode	Demand mode session.
mac-address	Indicate the mac-address parameter.
MAC	Specify the actual destination MAC address.

Command Mode

Interface mode

Examples

```
#configure terminal
(config)#interface eth1
(config-if)##bfd session 1:1::1:1 1:1::1:1 non-persistent admin-down

(config-if)#no bfd session 1.2.3.4 1.2.3.5 non-persistent admin-down
(config-if)#exit

#configure terminal
(config)#interface eth1
(config-if)#bfd session data-link-oam mac-address 1:1::1:1

(config-if)#no bfd session data-link-oam mac-address 1:1::1:1
```

bfd slow-timer

Use this command to set a BFD slow timer interval.

Use the `no` form of the command to reset the timer to default values.

Command Syntax

```
bfd slow-timer <1000-3000>
no bfd slow-timer <1000-3000>
```

Parameter

`<1000-3000>`	Interval for the slow-timer in milliseconds

Command Mode

Configure mode

Default

Default slow-timer value is 2000

Example

```
#configure terminal
(config)#bfd slow-timer 1500
(config)#
```

debug bfd

Use this command to enable debugging for BFD.

Use the `no` form of the command to disable all debugging for BFD.

Command Syntax

```
debug bfd (all|)
debug bfd (event|ipc-error|ipc-event|nsm|packet|session)
no debug bfd (all|)
no debug all
no debug all bfd
no debug bfd (event|ipc-error|ipc-event|nsm|packet|session)
```

Parameters

`all`	Enable all debugging.
`event`	Enable BFD event debugging.
`ipc-error`	Enable BFD IPC-error debugging
`ipc-event`	Enable BFD IPC-event debugging.
`nsm`	Enable BFD NSM debugging.
`packet`	Enable BFD packet debugging.
`session`	Enable BFD session debugging.

Command Mode

Exec, Privileged Exec and Configure Mode

Examples

```
#debug bfd all
#no debug bfd all
#debug bfd event
#debug bfd ipc-error
#debug bfd ipc-event
#debug bfd nsm
#debug bfd packet
#debug bfd session
```

key

Use this command to manage, add or delete authentication keys in a key-chain. This command allows you to enter the keychain-key mode to set a password for the key.

Command Syntax

```
key <0-2147483647>
no key <0-2147483647>
```

Parameters

`<0-2147483647>` Specify a key identifier.

Default

By default, BFD uses level-1-2 if there is no Level-2 instance nor a Level-1-2 instance. Otherwise, it uses level-1.

Command Mode

Keychain mode

Examples

The following example configures a key number 1 and shows the change to keychain-key command mode.

```
#configure terminal
(config)#key chain mychain
(config-keychain)#key 1
(config-keychain-key)#
```

key chain

Use this command to enter the key chain management mode and to configure a key chain with a key chain name. This command allows you to enter the keychain mode to specify keys on this key chain.

Command Syntax

```
key chain WORD
no key chain WORD
```

Parameters

WORD	Specify the name of the key chain to manage.

Command Mode

Configure mode

Examples

The following example shows the creation of a key chain named `mychain` and the change to keychain mode:

```
#configure terminal
(config)#key chain mychain
(config-keychain)#
```

send-lifetime

Use this command to specify the time period during which the authentication key on a key chain can be sent.

Use the `no` parameter with this command to negate this command.

Command Syntax

```
send-lifetime HH:MM:SS <1-31> MONTH <1993-2035> HH:MM:SS <1-31> MONTH <1993-2035>
send-lifetime HH:MM:SS <1-31> MONTH <1993-2035> HH:MM:SS MONTH <1-31> <1993-2035>
send-lifetime HH:MM:SS MONTH <1-31> <1993-2035> HH:MM:SS <1-31> MONTH <1993-2035>
send-lifetime HH:MM:SS MONTH <1-31> <1993-2035> HH:MM:SS MONTH <1-31> <1993-2035>
send-lifetime HH:MM:SS <1-31> MONTH <1993-2035> infinite
send-lifetime HH:MM:SS MONTH <1-31> <1993-2035> infinite
send-lifetime HH:MM:SS <1-31> MONTH <1993-2035> duration <1-2147483646>
send-lifetime HH:MM:SS MONTH <1-31> <1993-2035> duration <1-2147483646>
no send-lifetime
```

Parameters

`HH:MM:SS`	Specify the start time of accept-lifetime in hours, minutes and seconds.
`<1-31>`	Specify the day of the month to start.
`MONTH`	Specify the month of the year to start as the first three letters of the month, for example, Jan.
`<1993-2035>`	Specify the year to start.
`HH:MM:SS`	Specify the end time of accept-lifetime in hours, minutes and seconds.
`<1-31>`	Specify the day of the month to end.
`MONTH`	Specify the month of the year to end as the first three letters of the month, for example, Jan.
`<1993-2035>`	Specify the year to end.
`duration`	Indicate the duration parameter.
`<1-2147483646>`	Specify the actual end time duration of a key in seconds.
`infinite`	Specify the end time to never expire.

Command Mode

Keychain-key mode

Examples

The following example shows the setting of `send-lifetime` for `key 1` on the key chain named `mychain`:

```
#configure terminal
(config)#key chain mychain
(config-keychain)#key 1
(config-keychain-key)#send-lifetime 03:03:01 Jan 3 2004 04:04:02 Dec 6 2006
```

show bfd

Use this command to display information about the BFD process.

Command Syntax

```
show bfd
```

Parameters

None

Command Mode

Exec mode and Privilege Exec mode

Example

The example below displays the command syntax and sample output from the command.

```
#show bfd
BFD ID: 00      Start Time:Fri May 1 09:55:06 2009
Number of Sessions:     1
Slow Timer: 1000        Image type: MONOLITHIC
Echo Mode: Disabled     Next Session Discriminator:    2
#
```

show bfd interface

Use this command to display details for an interface running BFD or for all interfaces configured for BFD.

Command Syntax

```
show bfd interface (ifindex <0-4294967295>|all|)
```

Parameters

`all`	Display all interfaces.
`ifindex`	Display an interface index.
`<0-4294967295>`	Display an ID of an interface in this range.

Command Mode

Exec mode and Privilege Exec mode

Example

The example below displays the command syntax and sample output from the command.

```
#show bfd interface all
Interface:         lo ifindex: 1 state:   UP
Interface level configuration: NO ECHO, NO SLOW TMR
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5

Interface:       eth0 ifindex: 2 state:   UP
Interface level configuration: NO ECHO, NO SLOW TMR
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5

Interface:       eth1 ifindex: 3 state: DOWN
Interface level configuration: NO ECHO, NO SLOW TMR
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5

Interface:       sit0 ifindex: 4 state: DOWN
Interface level configuration: NO ECHO, NO SLOW TMR
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5

Interface:       gre0 ifindex: 5 state: DOWN
Interface level configuration: NO ECHO, NO SLOW TMR
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5
```

show bfd session

Use this command to display all BFD sessions.

Command Syntax

```
show bfd session (detail|)
```

Parameters

`detail`	Display session details.

Command Mode

Exec mode and Privilege Exec mode

Example

The example below displays the command syntax and sample output from the command using the `detail` parameter.

```
#show bfd session detail
Session Interface Index : 3              Session Index : 1
Lower Layer : IPv4                       Version : 1
Session Type : Single Hop                Session State : Down
Local Discriminator : 1                  Local Address : 19.19.19.2/32
Remote Discriminator : 0                 Remote Address : 19.19.19.1/32
Local Port : 49152                       Remote Port : 3784
Options :

Diagnostics: None

Timers in Milliseconds :
Min Tx: 20               Min Rx: 20               Multiplier: 5
Neg Tx: 0                Neg Rx: 0                Neg detect mult: 0
Min echo Tx: 20          Min echo Rx: 10          Neg echo intrvl: 0
Storage type: 2
Sess down time: 00:00:00
Sess discontinue time : 00:00:00
Bfd GTSM Disabled
Auth: Enabled | Disabled
Auth-Type: Simple | (Keyed | Meticulous-keyed) MD5 | SHA1
Auth-Key-Id: <0-255>

Counters values:
Pkt In : 0000000000000000                Pkt Out : 0000000000000011
Echo Out : 0000000000000000              IPv6 Echo Out : 0000000000000000
IPv6 Pkt In : 0000000000000000           IPv6 Pkt Out : 0000000000000000
UP Count : 0                             UPTIME : 00:00:00

Protocol Client Info:
BFD-> Client ID: 28      Flags: 4
------------------------------------------------------------
Number of Sessions:    1
#
```

show bfd session A.B.C.D

Use this command to display information about an IPv4 BFD session neighbor.

Command Syntax

```
show bfd session A.B.C.D A.B.C.D (detail|)
show bfd session A.B.C.D A.B.C.D <0-4294967295> (detail|)
```

Parameters

A.B.C.D	Display the local IPv4 address.
A.B.C.D	Display the neighbor IPv4 address.
<0-4294967295>	Display the interface index of the address.
detail	Display detailed information.

Command Mode

Exec mode and Privilege Exec mode

Example

The example below displays the command syntax and sample output from the command.

```
#show bfd session 10.1.1.66 10.1.1.67 3
Session Interface Index: 3     Session Index: 1
Lower Layer: IPv4     Single Hop
Session State: Up
Local Discriminator: 1 Remote Discriminator: 163
Local Address: 10.1.1.66/32    Remote Address: 10.1.1.67/32
Local Port: 49152      Remote Port: 3784
Timers in Milliseconds
Min Tx: 1000 Min Rx: 1000 Multiplier: 4
UP Count: 1 UPTIME: 00:10:08
```

show bfd session ipv6

Use this command to display information about an IPv6 BFD session neighbor.

Command Syntax

```
show bfd session ipv6 X:X::X:X X:X::X:X (detail|)
show bfd session ipv6 X:X::X:X X:X::X:X <0-4294967295> (detail|)
```

Parameters

`X:X::X:X`	Display the local IPv6 address.
`X:X::X:X`	Display the neighbor IPv6 address.
`<0-4294967295>`	Display the interface index of the address.
`detail`	Display detailed information.

Command Mode

Exec mode and Privileged Exec mode

Example

The example below displays the command syntax and sample output from the command.

```
#show bfd session 2001::1222 2001::1223 3
Session Interface Index : 3     Session Index: 1
Lower Layer: IPv6     Single Hop
Session State : Up
Local Discriminator : 1 Remote Discriminator: 163
Local Address : 2001::1222/128    Remote Address: 2001::1223/128
Local Port : 49152      Remote Port: 3784
Timers in Milliseconds
Min Tx: 1000 Min Rx: 1000 Multiplier: 4
UP Count: 1 UPTIME: 00:06:03
```

show debugging bfd

Use this command to display debugging information for BFD processes.

Command Syntax

```
show debugging bfd
```

Parameters

None

Command Mode

Exec mode and Privileged Exec mode

Example

The example below displays the command syntax and sample output from the command.

```
#show debugging bfd
BFD debugging status:
BFD events debugging is on
BFD packet debugging is on
BFD ipc-error debugging is on
BFD ipc-event debugging is on
BFD session debugging is on
BFD nsm debugging is on
#
```

snmp restart bfd

Use this command to restart SNMP in Bidirectional Forwarding (BFD)

Command Syntax

```
snmp restart bfd
```

Parameters

None

Command Mode

Configure mode

Examples

```
#configure terminal
(config)#snmp restart bfd
```

CHAPTER 3 Protocol Commands for BFD

The chapter describes the commands used to manage BFD functionality for the OSPF, IS-IS and BGP protocol modules. It includes the following commands:

area virtual-link

Use this command to enable the BFD option for a specified virtual-link neighbor.

Use the `no` form of the command to disable BFD on a virtual-link neighbor.

Command Syntax

```
area (A.B.C.D|<0-4294967295>) virtual-link A.B.C.D {fall-over bfd}
no area (A.B.C.D|<0-4294967295>) virtual-link A.B.C.D {fall-over bfd}
```

Parameters

`A.B.C.D`	Indicate an area IP address
`<0-429467295>`	Indicate an area ID in integer format
`virtual-link`	Indicate a virtual link and its parameters
`A.B.C.D`	Indicate the IP address of the virtual link
`fall-over`	Indicate fall-over detection
`bfd`	Specify the Bidirectional Forwarding Detection (BFD)

Command Mode

Router mode

Example

```
#configure terminal
(config)#router ospf
(config-router)#area 1 virtual-link 192.168.0.1 fall-over bfd
```

bfd all-interfaces

Use this command to enable BFD for all neighbors maintained by an OSPF or RIP process, or an ISIS instance.

Use the `no` form of the command to disable BFD.

Note: This command does not apply BFD to virtual-link neighbors.

Command Syntax

```
bfd all-interfaces
no bfd all-interfaces
```

Parameters

None

Command Mode

Configure router mode

Example

```
#configure terminal
(config)#router ospf
(config-router)#bfd all-interfaces

#configure terminal
(config)#router isis
(config-router)#bfd all-interfaces

#configure terminal
(config)#router rip
(config-router)#bfd all-interfaces
```

debug bgp bfd

Use this command to debug BFD processes in BGP.

Use the `no` form of the command to stop debugging.

Command Syntax

```
debug bgp bfd
no bgp debug bfd
undebug bgp bfd
```

Parameters

None

Command Mode

Configure mode

Example

```
#configure terminal
(config)#debug bgp bfd
```

debug isis bfd

Use this command to debug BFD processes in IS-IS.

Use the `no` form of the command to stop debugging.

Command Syntax

```
debug isis bfd
no debug isis bfd
undebug isis bfd
```

Parameters

None

Command Mode

Configure mode

Example

```
#configure terminal
(config)#debug isis bfd
```

debug ospf bfd

Use this command to debug BFD processes in OSPF.

Use the `no` form of the command to stop debugging.

Command Syntax

```
debug ospf bfd
no debug ospf bfd
undebug ospf bfd
```

Parameters

None

Command Mode

Configure mode

Example

```
#configure terminal
(config)#debug ospf bfd
```

debug rip bfd

Use this command to debug BFD processes in RIP.

Use the `no` form of the command to stop debugging.

Command Syntax

```
debug rip bfd
no debug rip bfd
```

Parameters

None

Command Mode

Configure mode

Example

```
#configure terminal
(config)#debug rip bfd
```

ip ospf bfd

Use this command to enable the BFD option for OSPF neighbors on an interface. Use the `no` form of the command to disable the BFD option for OSPF neighbors on an interface.

Command Syntax

```
ip ospf bfd (disable|)
no ip ospf bfd (disable|)
```

Parameter

`disable`	Disable the BFD option for neighbors on an interface

Command Mode

Interface mode

Example

```
#configure terminal
(config)#interface eth1
(config-if)#ip ospf bfd
```

isis bfd

Use this command to enable the BFD option for IS-IS neighbors on an interface. Use the `no` form of the command to disable the BFD option for neighbors on an interface.

Command Syntax

```
isis bfd (disable|)
no isis bfd (disable|)
```

Parameter

`disable`	Used to disable the BFD option for neighbors on an interface

Command Mode

Interface mode

Example

```
#configure terminal
(config)#interface eth1
(config-if)#isis bfd disable
```

neighbor fall-over bfd (BGP)

Use this command to enable the BFD option on an IPv4 or IPv6 BGP peer.

Use the `no` form of the command to disable the BFD option on a BGP peer.

Command Syntax

```
neighbor (A.B.C.D|X:X::X:X) fall-over bfd (multihop|)
no neighbor (A.B.C.D|X:X::X:X) fall-over bfd (multihop|)
```

Parameters

`A.B.C.D`	Peer address in an IPv4 format
`X:X::X:X`	Peer address in an IPv6 format
`multihop`	Enable multihop

Command Mode

Router mode

Example

```
(config)#router bgp 10
(config-router)#neighbor 10.10.0.1 fall-over bfd
```

neighbor fall-over bfd (RIP)

Use this command to enable the BFD option on an IPv4 RIP peer.

Use the `no` form of the command to disable the BFD option on an IPv4 RIP peer.

Command Syntax

```
neighbor A.B.C.D fall-over bfd
no neighbor A.B.C.D fall-over bfd
```

Parameters

`A.B.C.D`	Peer address in an IPv4 format

Command Mode

Router mode

Example

```
(config)#router rip
(config-router)#neighbor 10.10.2.9 fall-over bfd
```

CHAPTER 4 BFD Static Route Commands

Bidirectional Forwarding Detection (BFD) support for static routes can be configured on a static route basis, interface basis, or on a global level:

- When BFD is configured for an IPv4 or IPv6 static route, BFD provides the next-hop reachability detection for the given static route.
- When BFD is configured for an interface, BFD provides the data plane next-hop reachability information for any IPv4 or IPv6 static route configured through the given interface.
- When BFD is configured globally, BFD is applied on all interfaces with a single command. In all these cases, the BFD session update for NSM governs the state of the static routes.

This chapter includes the following commands:

ip bfd static all-interfaces

Use this command to enable BFD support for IPv4 static routes configured on all interfaces.

Use the `no` option with this command to disable BFD support for IPv4 static routes configured on all interfaces.

Command Syntax

```
ip bfd static all-interfaces
no ip bfd static all-interfaces
```

Parameters

None

Command Mode

Configure mode

Example

```
#configure terminal
(config)#ip bfd static all-interfaces
```

ip static fall-over bfd

Use this command to enable or disable BFD support for a specific IPv4 static route.

Use the `no` form of the command to disable the BFD support for a specific IPv4 static route.

Command Syntax

```
ip static A.B.C.D/M A.B.C.D fall-over bfd (disable|)
no ip static A.B.C.D/M A.B.C.D fall-over bfd (disable|)
```

Parameters

`A.B.C.D/M`	The IPv4 destination prefix and mask length.
`A.B.C.D`	The IPv4 gateway address.
`disable`	Specify to disable BFD.

Command Mode

Configure mode

Example

```
#configure terminal
(config)#ip static 4.4.4.4/32 20.0.10.82 fall-over bfd
```

ip static bfd

Use this command to enable or disable BFD support for IPv4 static route(s) configured on an interface.

Use the `no` option with this command to reset BFD support for IPv4 static route(s) configured on an interface.

Command Syntax

```
ip static bfd (disable|)
no ip static bfd (disable|)
```

Parameters

None

Command Mode

Interface mode

Default

By default, BFD static route support is disabled at all levels.

Example

```
#configure terminal
(config)#interface eth1
(config-if)#ip static bfd disable

(config)#interface eth1
(config-if)#ip static bfd
```

ipv6 static all-interfaces

Use this command to enable or disable BFD support for IPv6 static routes configured on all interfaces.

Use the `no` option with this command to disable BFD support for IPv6 static routes configured on all interfaces.

Command Syntax

```
ipv6 bfd static all-interfaces
no ipv6 bfd static all-interfaces
```

Parameters

None

Command Mode

Configure mode

Example

```
#configure terminal
(config)#ipv6 bfd static all-interfaces
```

ipv6 static fall-over bfd

Use this command to enable or disable BFD support for a specific IPv6 static route.

Use the `no` option with this command to disable BFD support for a specific IPv6 static route.

Command Syntax

```
ipv6 static X:X::X:X/M X:X::X:X fall-over bfd (disable|)
no ipv6 static X:X::X:X/M X:X::X:X fall-over bfd (disable|)
```

Parameters

`X:X::X:X/M`	The IPv6 destination prefix and mask length.
`X:X::X:X`	The IPv6 gateway address.
`disable`	Specify to disable BFD.

Command Mode

Configure mode

Examples

```
#configure terminal
(config)#ipv6 static 2345:6::0:1/28 2345:6::0:2 fall-over bfd

#configure terminal
(config)#ipv6 static 2345:12::1/64 2345:12::2 fall-over bfd disable
```

ipv6 static bfd

Use this command to disable BFD support for IPv6 static route(s) configured on an interface.

Use the `no` option with this command to reset BFD support for IPv6 static route(s) configured on an interface.

Command Syntax

```
ipv6 static bfd (disable|)
no ipv6 static bfd (disable|)
```

Parameters

None

Command Mode

Interface mode

Example

```
#configure terminal
(config)#interface eth1
(config-if)#ipv6 static bfd disable
```

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