

# BIG-IP® Advanced Routing™

## Bidirectional Forwarding Detection Configuration Guide

Version 7.10.6





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# Preface

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This configuration guide is for network administrators and application developers intending to configure the ZebOS® BFD protocol. This guide attempts to make configuration simpler by adding topology illustrations and configuration samples. It covers basic configurations for Basic Access Networking Services. Use this guide in conjunction with the *ZebOS Bidirectional Forwarding Detection Command Line Interface Reference Guide* to get complete information on the commands used in the configurations displayed in this guide.

## Conventions

The following table displays the conventions for the syntax and procedures describing how to enter information, and how information displays on the console.

Convention	Description
command syntax	The new <code>courier</code> font represents command strings entered on a command line, and sample source code.
UPPERCASE	A variable parameter. Enter a value according to the descriptions that follow.
lowercase	A keyword parameter. Enter lowercase values exactly as shown
	The vertical bar. Delimits choices; select one from the list.
( )	Parenthesis. Delimits optional parameters. Do not enter parentheses as part of any command.
[ ]	Square brackets: groups parameters and keywords into a single unit. Take all parts within these brackets. Do not enter brackets as part of any command.
< >	Angle brackets: enclose a numeric range for a keyword. Do not enter angle brackets as part of any command.
description	Proportional font gives specific details about a parameter.
=	Equal sign: separates the command syntax from explanatory text.

Note: Unless otherwise stated, press Enter after each command entry.

## Configuration Format

The following table describes the configuration format used in this guide.

Format	Description	Example
<b>Scenario Description</b>	This section includes a description of both the topology and the configuration.	<b>Enabling RIP</b> This example shows the minimum configuration required for enabling RIP on an interface.
<b>Topology</b>	This section is an illustration of the topology. The figure might include the IP addresses and names of the devices used in the example.	
<b>Configuration</b>	This section has the complete configuration involved in the example. The prompt shows the execution modes of the commands.	<pre>R1 ZebOS#configure terminal ZebOS (config)#router rip ZebOS (config-router)#net... ZebOS (config-router)#net...</pre>
<b>Explanation</b>	The grey section next to the configuration provides an explanation of the action performed by a configuration.	<pre>Configure interface in bridge group Configure interface mode as trunk. Allow all VLANs on interface eth2.</pre>
<b>Commands Used</b>	This section lists the names of the commands used in the example. Users can look up the details of these commands in the specific command line reference guide. To avoid repetition, this section does not include common commands, such as “configure terminal. “	<b>Commands Used</b> router rip, network
<b>Validation Commands</b>	This section has the show commands that display the validation output.	<b>Validation Commands</b> show ip rip

## Command Line Interface

The ZebOS™ Command Line Interface (CLI) is a text-based interface that is used to interact with systems. Users can utilize many of the commands in scripts to automate many configuration tasks. Each command associates with a specific function or a common function performing a specific task. Multiple users can telnet and issue commands using the Exec mode and the Privileged Exec mode. The VTY shell, described in the ZebOSVTY Shell User Guide, gives users and administrators the ability to issue commands to several daemons from a single telnet session.



## Command Line Help

The ZebOSCLI contains a text-based help facility. Access this help by typing in the full or partial command string, then typing "?". The ZebOSCLI displays the command keywords or parameters plus a short description. For example, at the CLI command prompt, type `show ?` (the CLI does not display the question mark). The CLI displays this keyword list with short descriptions for each keyword:

```

bgpd#show
  access-list      List IP access lists
  bfd              Bidirectional Forwarding Detection (BFD)
  bgp              Border Gateway Protocol (BGP)
  cli              Show CLI tree of current mode
  clns             Connectionless-Mode Network Service (CLNS)
  debugging        Debugging functions (see also 'undebug')
  faults           Show recorded faults
  history          Display the session command history
  interface        Interface status and configuration
  ip               Internet Protocol (IP)
  ipv6             Internet Protocol version 6 (IPv6)
  isis             Intermediate System-Intermediate System
  list             Show command lists
  mrib             MRIB
  nsm              NSM
  privilege        Show current privilege level
  proc-names       Show process names
  process          Process
  route-map        route-map information
  router-id        Router ID
  running-config   Current Operating configuration

```

## Syntax Help

The ZebOSCLI can complete the spelling of command or parameter keywords. Begin typing the command or parameter, then press TAB. At the CLI command prompt, type `sh`:

```
Router> sh
```

Press TAB. The CLI shows:

```
Router> show
```

If the command or parameter partial spelling is ambiguous, the CLI displays the choices that match the abbreviation. Type `show i`. Press TAB. The CLI shows:

```
Router> show i
interface ip
Router> show i
```

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

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

Now type `?` and the CLI shows a list of parameters for the `show interface` command.

```
[IFNAME] Interface name
Router> show interface
```

## Command Abbreviations

The CLI accepts abbreviations for commands. For example, the following is an abbreviation for `show interface`.

```
sh in
```

## Command line errors

If the router does not recognize the command after ENTER is pressed, it displays this message:

```
% Invalid input detected at '^' marker.
```

If a command is incomplete, it displays this message:

```
% Incomplete command.
```

Some commands are too long for the display line, and can wrap in mid-parameter or mid-keyword, if necessary:

```
area 10.10.0.18 virtual-link 10.10.0.19 authentication-key 57393
```

## Command Modes

The commands available for each protocol separate into several modes (nodes) arranged in a hierarchy; Exec is the lowest. Each mode has its own special commands; in some modes, commands from a lower mode are available.

### Modes Common to Protocols

Mode	Description
Exec	Also called the View mode, use this mode to perform basic commands, such as, show, exit, quit, help, list, and enable. This is the initial mode when users log in to any ZebOSCLI.
Privileged Exec	Also called the Enable mode, this mode allows users to perform debugging commands, write commands (for saving and viewing the configuration), and show commands.
Configure	Also called the Configure Terminal, this mode includes configuration commands and serves as a gateway to other configuration modes, including Interface, Router, Line, Route Map, Key Chain and Address Family modes. All ZebOSdaemons have this mode.
Interface	Use this mode to configure protocol-specific settings for a particular interface. Any attribute configured in this mode overrides an attribute configured in the router mode.
Line	Use this mode to make access-class commands available.

### Modes Specific to Protocols

The following command modes are specific to a variety of protocols. The command used to enter these modes is different for each protocol.

Mode	Description
Router	Known as the Configure Router mode, this mode is available for the LDP, BGP, OSPF, RSVP-TE and RIP protocols. It provides access to router and routing command.
Route-map	Use this mode to set route metric, route-length and cost data. It is available for the BGP, OSPF, and RIP protocols.
Address Family	Use this mode for multiprotocol BGP extension. It includes address family-specific commands.
Key Chain	Use this mode to manage the key chain. It is available for the RIP and ISIS protocols.
Trunk	Use this mode to create or modify RSVP trunks. A trunk is the static definition for a Labeled Switch Path (LSP).
Path	Use this mode to create or modify RSVP paths.

# CHAPTER 1 Base BFD Configuration

This chapter provides the steps for configuring the base Bidirectional Forwarding Detection (BFD) setup.

## Topology



Figure 1: Basic Topology of Three Routers

### BFD Echo Function

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#bfd echo	Enable BFD echo mode.

### BFD Slow Timer

ZebOS#configure terminal	Enter the the Configure mode.
ZebOS(config)#bfd slow-timer 1000	Configure BFD slow-timer in milliseconds.

### BFD Multihop Peer Timer

ZebOS#configure terminal	Enter Configure mode.
ZebOS(config)#bfd multihop-peer 20.1.1.3 interval 100 minrx 100 multiplier 3	Configure BFD multihop-peer timer and reception intervals in milliseconds, and the Hello multiplier.

### BFD Single-hop Session Timer

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth1	Enter the Interface mode.
ZebOS(config-if)#bfd interval 100 minrx 100 multiplier 4	Configure BFD single-hop sessions timer and reception interval in millisecond, and the Hello multiplier.

### BFD Echo Interval

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth1	Enter the Interface mode.
ZebOS(config-if)#bfd echo interval 100	Configure BFD echo interval in milliseconds.



# CHAPTER 2 BFD Protocol Configurations

This chapter describes the BFD protocol configurations.

## OSPF—BFD Single-Hop Session

This section provides the steps for configuring BFD for Single-Hop OSPF.

### Topology

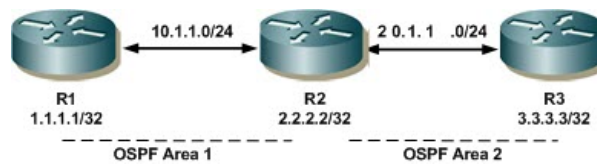


Figure 2: Single-Hop OSPF Topology

### Configuration for R1

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router ospf 100	Enter the Router mode for OSPF.
ZebOS(config-router)#network 10.1.1.0/24 area 1	Advertise network 10.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 1.1.1.1/32 area 1	Advertise loopback to network 1.1.1.1/32 in OSPF area 1.
ZebOS(config-router)#bfd all-interfaces	Enable BFD for all neighbors.

### Configuration for R2

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router ospf 100	Enter the Router mode for OSPF.
ZebOS(config-router)#network 10.1.1.0/24 area 1	Advertise network 10.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 20.1.1.0/24 area 1	Advertise network 20.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 2.2.2.2/32 area 1	Advertise loopback to network 2.2.2.2/32 in OSPF area 1.
ZebOS(config-router)#bfd all-interfaces	Enable BFD for all neighbors.

### Configuration for R3

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router ospf 100	Enter the Router mode for OSPF.

## BFD Protocol Configurations

---

ZebOS(config-router)#network 20.1.1.0/24 area 1	Advertise network 20.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 3.3.3.3/32 area 1	Advertise loopback to network 3.3.3.3/32 in OSPF area 1.
ZebOS(config-router)#bfd all-interfaces	Enable BFD for all neighbors

### Validation

The example that follows is the output of the command:

```
ZebOS#show bfd session
Session Interface Index : 3      Session Index: 1
Lower Layer: IPv4      Single Hop
Session State : Up
Local Discriminator : 1 Remote Discriminator: 1
Local Address : 10.1.1.67/32 Remote Address: 10.1.1.66/32
Local Port : 49152 Remote Port: 3784
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5
UP Count: 1 UPTIME: 00:14:12
Session Interface Index : 4      Session Index: 4
Lower Layer: IPv4      Single Hop
Session State : Up
Local Discriminator : 4 Remote Discriminator: 4
Local Address : 20.1.1.67/32 Remote Address: 20.1.1.68/32
Local Port : 49155 Remote Port: 3784
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5
UP Count: 1 UPTIME: 00:01:12
Number of Sessions: 2
```

## OSPF—BFD Multi-Hop Session

This section provides the steps for configuring BFD for OSPF multi-hop sessions.

### Topology

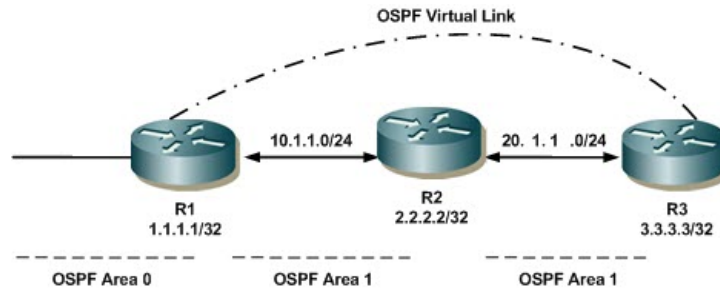


Figure 3: Multi-hop OSPFv3 Topology

### Configuration for R1

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router ospf 100	Enter the Router mode for OSPF.
ZebOS(config-router)#network 10.1.1.0/24 area 1	Advertise network 10.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 1.1.1.1/32 area 1	Advertise loopback to network 1.1.1.1/32 in OSPF area 1.
ZebOS(config-router)#network 30.1.1.0/24 area 0	Advertise network 30.1.1.0/24 in OSPF area 0.
ZebOS(config-router)#area 1 virtual-link 3.3.3.3 fall-over bfd	Create a virtual link to R3 with BFD.

### Configuration for R2

ZebOS#configure terminal	Enter the Configure mode
ZebOS(config)#router ospf 100	Enter the Router mode for OSPF.
ZebOS(config-router)#network 10.1.1.0/24 area 1	Advertise network 10.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 20.1.1.0/24 area 1	Advertise network 20.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 2.2.2.2/32 area 1	Advertise loopback to network 2.2.2.2/32 in OSPF area 1.

## Configuration for R3

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router ospf 100	Enter the Router mode for OSPF.
ZebOS(config-router)#network 20.1.1.0/24 area 1	Advertise network 20.1.1.0/24 in OSPF area 1.
ZebOS(config-router)#network 3.3.3.3/32 area 1	Advertise loopback to network 3.3.3.3/32 in OSPF area 1.
ZebOS(config-router)#area 1 virtual-link 1.1.1.1 fall-over bfd	Create a virtual link to R1 with BFD.

## Validation

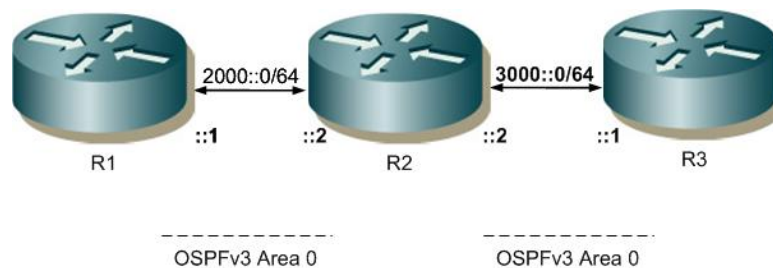
The example that follows is the output of the command:

```
ZebOS#show bfd session
Session Interface Index : 0      Session Index: 2
Lower Layer: IPv4      Multihop Arbit Path
Session State : Up
Local Discriminator : 2 Remote Discriminator: 1
Local Address : 10.1.1.66/32 Remote Address: 20.1.1.68/32
Local Port : 49153      Remote Port: 4784
Min Tx: 2 Min Rx: 20 Multiplier: 5
UP Count: 1 UPTIME: 00:03:58
Number of Sessions: 1
```

## OSPFv3—BFD Single-Hop Session

This section provides the steps for configuring BFD for single-hop OSPFv3.

## Topology



**Figure 4: Single-Hop OSPFv3 Topology**



## Configuration for R1

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth1	Enter the Interface mode for eth1.
ZebOS(config-if)#ipv6 address 2000::1/64	Configure IPv6 address for the interface eth1.
ZebOS(config-if)#ipv6 router ospf area 0	Enable OSPFv3 on the interface in area 0.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#router ipv6 ospf 100	Enter the Router mode for OSPFv3.
ZebOS(config-router)#router-id 1.1.1.1	Configure OSPFv3 Router-ID.
ZebOS(config-router)#bfd all-interfaces	Enable BFD on all OSPFv3 enabled interfaces.
ZebOS(config-router)#exit	Exit from the Router mode.

## Configuration for R2

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth1	Enter the Interface mode eth1.
ZebOS(config-if)#ipv6 address 2000::2/64	Configure IPv6 address for the interface eth1.
ZebOS(config-if)#ipv6 router ospf area 0	Enable OSPFv3 on the interface in area 0.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#interface eth2	Enter the Interface mode for eth2.
ZebOS(config-if)#ipv6 address 3000::2/64	Configure IPv6 address for the interface eth2.
ZebOS(config-if)#ipv6 router ospf area 0	Enable OSPFv3 on the interface in area 0.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#router ipv6 ospf 100	Enter the Router mode for OSPFv3.
ZebOS(config-router)#router-id 2.2.2.2	Configure OSPFv3 Router-ID.
ZebOS(config-router)#bfd all-interfaces	Enable BFD on all OSPFv3 enabled interfaces.
ZebOS(config-router)#exit	Exit from the Router mode.

## Configuration for R3

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth1	Enter the Interface mode for eth1.
ZebOS(config-if)#ipv6 address 3000::1/64	Configure IPv6 address for the interface eth1.
ZebOS(config-if)#ipv6 router ospf area 0	Enable OSPFv3 on the interface in area 0.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#router ipv6 ospf 100	Enter the Router mode for OSPFv3.
ZebOS(config-router)#router-id 3.3.3.3	Configure OSPFv3 Router-ID.
ZebOS(config-router)#bfd all-interfaces	Enable BFD on all OSPFv3 enabled interfaces.
ZebOS(config-router)#exit	Exit from the Router mode.

## Validation

This section provides the output of show commands used to confirm the configurations for BFD for single-hop OSPFv3.

ZebOS#**show bfd session**

Sess-Idx	Remote-Disc	Lower-Layer	Sess-Type	Sess-State	UP-Time	Remote-Addr
20	12	IPv6	Single-Hop	Up	00:00:33	fe80::5054:ff:fe31:3233/128
21	1	IPv6	Single-Hop	Up	00:00:26	fe80::7074:ff:fe72:7374/128

Number of Sessions: 2

ZebOS#**show bfd session detail**

=====

Session Interface Index : 3	Session Index : 10
Lower Layer : IPv6	Version : 1
Session Type : Single Hop	Session State : Up
Local Discriminator : 10	Local Address : fe80::5054:ff:fe31:3233/128
Remote Discriminator : 12	Remote Address : fe80::7074:ff:fe72:7374/128
Local Port : 49161	Remote Port : 13784
Options :	

Diagnostics : None

Timers in Milliseconds :

Min Tx: 1000	Min Rx: 1000	Multiplier: 2
Neg Tx: 1000	Neg Rx: 1000	Neg detect mult: 2
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  
Bfd Authentication Disabled

### BFD Protocol Configurations

Counters values:

Pkt In : 0000000000000000	Pkt Out : 0000000000000000
Echo Out : 0000000000000000	IPv6 Echo Out : 0000000000000000
IPv6 Pkt In : 00000000000000494	IPv6 Pkt Out : 000000000000004e3
UP Count : 4	UPTIME : 00:15:09

Protocol Client Info:

OSPF6-> Client ID: 5      Flags: 4

-----

Session Interface Index : 3	Session Index : 19
Lower Layer : IPv4	Version : 1
Session Type : Single Hop	Session State : Up
Local Discriminator : 19	Local Address : 2.2.2.1/32

---

---

Remote Discriminator : 13                      Remote Address : 2.2.2.2/32  
Local Port : 49170                            Remote Port : 3784  
Options :

Diagnostics : None

Timers in Milliseconds :

Min Tx: 1000                      Min Rx: 1000                      Multiplier: 2  
Neg Tx: 1000                      Neg Rx: 1000                      Neg detect mult: 2  
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  
Bfd Authentication Disabled

Counters values:

Pkt In : 000000000000006f                      Pkt Out : 000000000000006c  
Echo Out : 0000000000000000                      IPv6 Echo Out : 0000000000000000  
IPv6 Pkt In : 0000000000000000                      IPv6 Pkt Out : 0000000000000000  
UP Count : 1                                      UPTIME : 00:01:36

Protocol Client Info:

RIP-> Client ID: 2                      Flags: 4

-----  
Number of Sessions:      2

## OSPFv3—BFD Multi-Hop Sessions

This section provides the steps for configuring BFD for OSPFv3 multi-hop sessions.

### Topology

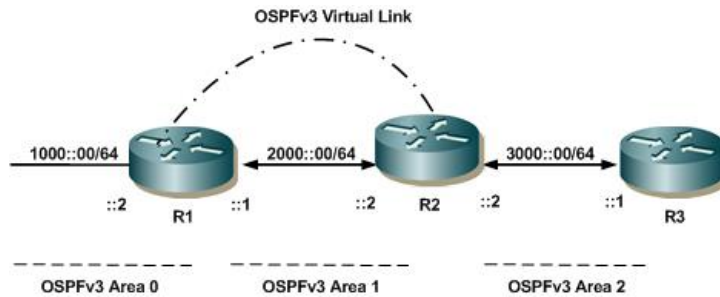


Figure 5: Multi-Hop OSPFv3 Topology

### Configuration for R1

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth2	Enter the Interface mode eth2.
ZebOS(config-if)#ipv6 address 1000::1/64	Configure IPv6 address for the interface eth2.
ZebOS(config-if)#ipv6 router ospf area 0	Enable OSPFv3 on the interface in area 0.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#interface eth1	Enter the Interface mode for eth1.
ZebOS(config-if)#ipv6 address 2000::1/64	Configure IPv6 address for the interface eth1.
ZebOS(config-if)#ipv6 router ospf area 1	Enable OSPFv3 on the interface in area 1.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#router ipv6 ospf 100	Enter the Router mode for OSPFv3.
ZebOS(config-router)#router-id 1.1.1.1	Configure OSPFv3 Router-ID.
ZebOS(config-router)#area 1 virtual-link 2.2.2.2 fall-over bfd	Create an OSPFv3 virtual-link to R2 with BFD.
ZebOS(config-router)#exit	Exit from the Router mode.

### Configuration for R2

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth1	Enter the Interface mode eth1.
ZebOS(config-if)#ipv6 address 2000::2/64	Configure IPv6 address for the interface eth1.
ZebOS(config-if)#ipv6 router ospf area 1	Enable OSPFv3 on the interface in area 1.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#interface eth2	Enter the Interface mode for eth2.
ZebOS(config-if)#ipv6 address 3000::2/64	Configure IPv6 address for the interface eth2.
ZebOS(config-if)#ipv6 router ospf area 2	Enable OSPFv3 on the interface in area 2.
ZebOS(config-if)#exit	Exit from the Interface mode.

ZebOS(config)#router ipv6 ospf 100	Enter the Router mode for OSPFv3.
ZebOS(config-router)#router-id 2.2.2.2	Configure OSPFv3 Router-ID.
ZebOS(config-router)#area 1 virtual-link 1.1.1.1 fall-over bfd	Create an OSPFv3 virtual-link to R1 with BFD.
ZebOS(config-router)#exit	Exit from the Router mode.

### Configuration for R3

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#interface eth1	Enter the Interface mode for eth1.
ZebOS(config-if)#ipv6 address 3000::1/64	Configure IPv6 address for the interface eth1.
ZebOS(config-if)#ipv6 router ospf area 2	Enable OSPFv3 on the interface in area 2.
ZebOS(config-if)#exit	Exit from the Interface mode.
ZebOS(config)#router ipv6 ospf 100	Enter the Router mode for OSPFv3.
ZebOS(config-router)#router-id 3.3.3.3	Configure OSPFv3 Router-ID.
ZebOS(config-router)#exit	Exit from the Router mode.

### Validation

This section provides the output of show commands used to confirm the configurations for BFD for OSPFv3 multi-hop sessions.

#### ZebOS#show bfd session

Sess-Idx	Remote-Disc	Lower-Layer	Sess-Type	Sess-State	UP-Time	Remote-Addr
14	24		IPv6		Multi-Hop	Up
00:01:14	2000::2/128					

Number of Sessions: 1

#### ZebOS#show bfd session detail

=====

Session Interface Index : 3	Session Index : 10
Lower Layer : IPv6	Version : 1
Session Type : Multi Hop	Session State : Up
Local Discriminator : 10	Local Address : 2000::1/128
Remote Discriminator : 12	Remote Address : 2000::2/128
Local Port : 49161	Remote Port : 13784
Options :	

Diagnostics : None

#### Timers in Milliseconds :

Min Tx: 1000	Min Rx: 1000	Multiplier: 2
Neg Tx: 1000	Neg Rx: 1000	Neg detect mult: 2
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		

Bfd Authentication Disabled

BFD Protocol Configurations

Counters values:

```
Pkt In : 00000000000000000000          Pkt Out : 00000000000000000000
Echo Out : 00000000000000000000        IPv6 Echo Out : 00000000000000000000
IPv6 Pkt In : 000000000000000000494     IPv6 Pkt Out : 00000000000000004e3
UP Count : 4                             UPTIME : 00:15:09
```

Protocol Client Info:

```
OSPF6-> Client ID: 5      Flags: 4
```

---

## BFD Configuration in IS-IS

This section provides the steps for configuring BFD for the IS-IS protocol.

---

### Topology



Figure 6: Basic Topology for BFD-ISIS

#### Configuration for R1

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router isis	Enter the Router mode for IS-IS.
ZebOS(config-router)#net 10.0000.0000.0001.00	Advertise network 10.0000.0000.0001.00 in IS-IS.
ZebOS(config-router)#bfd all-interface	Enable BFD for all neighbors.

#### Configuration for R2

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router isis	Enter the Router mode for IS-IS.
ZebOS(config-router)#net 10.0000.0000.0002.00	Advertise network 10.0000.0000.0001.00 in IS-IS.
ZebOS(config-router)#bfd all-interface	Enable BFD for all neighbors.

## BFD Configuration in BGP

This section provides the steps for configuring BFD for the BGP protocol.

### Topology



Figure 7: Basic Topology for BFD in BGP

### Configuration for R1

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router bgp 100	Enter the Router mode for BGP.
ZebOS(config-router)#neighbor 3.3.3.3 remote-as 100	Add the neighbor 3.3.3.3/32 to remote-as 100.
ZebOS(config-router)#neighbor 3.3.3.3 fall- over bfd multihop	Enable the BFD option for the neighbor.

### Configuration for R2

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router bgp 100	Enter the Router mode for BGP.
ZebOS(config-router)#neighbor 2.2.2.2 remote-as 100	Add the neighbor 2.2.2.2 to remote-as 100.
ZebOS(config-router)#neighbor 2.2.2.2 fall- over bfd multihop	Enable the BFD option for the neighbor.

### Configuration for R3

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router bgp 100	Enter the Router mode for BGP.
ZebOS(config)#router bgp 100	Configure BGP.
ZebOS(config-router)#neighbor 1.1.1.1 remote-as 100	Add the neighbor 1.1.1.1 to remote-as 100.
ZebOS(config-router)#neighbor 1.1.1.1 fall- over bfd multihop	Enable the BFD option for the neighbor.

---

## BFD Configuration in RIP

This section provides the steps for configuring BFD for the RIP protocol.

---

### Topology

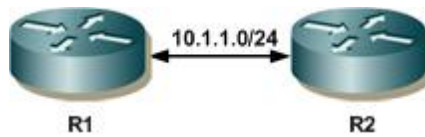


Figure 8: Basic Topology for BFD in RIP

### Configuration for R1

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router rip	Enter the Router mode for RIP.
ZebOS(config-router)#network 10.1.1.0/24	Advertise network 10.1.1.0/24 in RIP.
ZebOS(config-router)#bfd all-interfaces	Enable BFD for all neighbors.
	<i>or</i>
ZebOS(config-router)#neighbor 10.1.1.2 fall-over bfd	Enable BFD for a specific RIP neighbor

### Configuration for R2

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#router rip	Enter the Router mode for RIP.
ZebOS(config-router)#network 10.1.1.0/24	Advertise network 10.1.1.0/24 in RIP.
ZebOS(config-router)#bfd all-interfaces	Enable BFD for all neighbors.
	<i>or</i>
ZebOS(config-router)#neighbor 10.1.1.1 fall-over bfd	Enable BFD for a specific RIP neighbor.

### Validation

This section provides the output of show commands used to confirm the configurations for BFD for the RIP protocol.

```
ZebOS#show bfd session
Sess-Idx  Remote-Disc  Lower-Layer  Sess-Type  Sess-State  UP-Time  Remote-Addr
1         1            IPv4         Single-Hop Up
00:05:01  10.1.1.1/32
Number of Sessions: 2
```



---

ZebOS#show bfd session detail

```
=====
Session Interface Index : 4           Session Index : 18
Lower Layer : IPv4                   Version : 1
Session Type : Single Hop            Session State : Up
```

BFD Protocol Configurations

```
Local Discriminator : 18             Local Address : 3.3.3.1/32
Remote Discriminator : 14            Remote Address : 3.3.3.2/32
Local Port : 49169                   Remote Port : 3784
Options :
```

Diagnostics : None

Timers in Milliseconds :

```
Min Tx: 1000           Min Rx: 1000           Multiplier: 2
Neg Tx: 1000           Neg Rx: 1000           Neg detect mult: 5
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

Bfd Authentication Disabled

Counters values:

```
Pkt In : 0000000000000702           Pkt Out : 0000000000000704
Echo Out : 0000000000000000         IPv6 Echo Out : 0000000000000000
IPv6 Pkt In : 0000000000000000       IPv6 Pkt Out : 0000000000000000
UP Count : 1                          UPTIME : 00:01:37
```

Protocol Client Info:

```
RIP-> Client ID: 2           Flags: 4
-----
```



# CHAPTER 3 BFD Static Route Configuration

This chapter describes the configurations for BFD static routes.

In order to establish alternate paths to destinations that have the least possible delay it is important to quickly detect any changes to static route validity. BFD detects the liveness of a static route's nexthop and then uses the nexthop's reachability information to determine whether routes are valid. Using BFD to reach a static route's nexthop also ensures that a static route is inserted in the forwarding database only when the nexthop neighbor is reachable.

## Topology

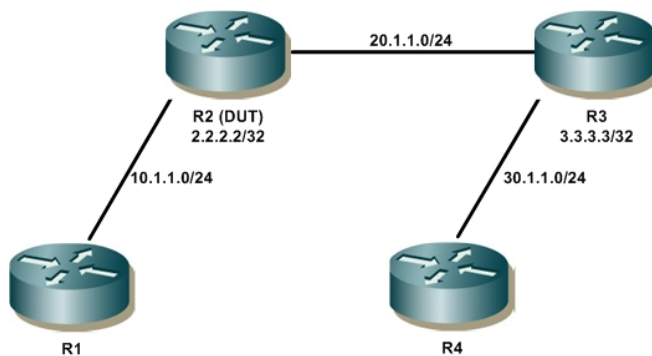


Figure 9: BFD Static Route Basic Topology

### Configuration for R2

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#ip router 30.1.1.0/24 20.1.1.3	Configure static route.
ZebOS(config)#ip bfd static all-interfaces	Enable BFD for all static routes.
ZebOS(config)#interface eth1	Enter the Interface configuration mode for eth1.
ZebOS(config-if)#ip static bfd	Enable static BFD on the interface.
ZebOS(config-if)#exit	Exit the Interface configuration mode.
ZebOS(config)#ip static 30.1.1.0/24 20.1.1.3 fall-over bfd	Enable static BFD at static route level.

### Configuration for R3

ZebOS#configure terminal	Enter the Configure mode.
ZebOS(config)#ip route 10.1.1.0/24 20.1.1.2	Configure static route.
ZebOS(config)#ip bfd static all-interfaces	Enable BFD for all static routes.
ZebOS(config)#int eth1	Enter the Interface configuration mode for eth1.
ZebOS(config-if)#ip static bfd	Enable static BFD at interface level.

## BFD Static Route Configuration

---

ZebOS(config-if)#exit	Exit the Interface configuration mode.
ZebOS(config)#ip static 20.1.1.0/24 10.1.1.2 fall-over bfd	Enable static BFD at static route level.

---

### Verification and Validation

Enter the commands listed in the following section to confirm the configurations.

#### Verify Traffic Class Groups Configuration

##### Show IP Route

```
ZebOS#show ip route
```

```
Codes: K - kernel, C - connected, S - static, R - RIP, B - BGP
       O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default

Gateway of last resort is 10.1.2.1 to network 0.0.0.0
K*    0.0.0.0/0 via 10.1.2.1, eth0
C     10.1.2.0/24 is directly connected, eth0
C     127.0.0.0/8 is directly connected, lo
K     169.254.0.0/16 is directly connected, eth0
ZebOS#
```

##### Show BFD Session Detail

```
ZebOS#show bfd session detail
```

```
-----
Session Interface Index: 5      Session Index: 1
Lower Layer:  IPv4      Version: 1      Session Type: Single Hop
Session State: Up
Local Discriminator: 1 Remote Discriminator: 1
Local Address: 20.1.1.2/32 Remote Address: 20.1.1.3/32
Local Port: 49152 Remote Port: 3784
Options:
Diagnostics: None
Timers in Milliseconds
Min Tx: 20 Min Rx: 20 Multiplier: 5
Min echo Tx: 20 Min echo Rx: 10 Neg Tx: 20
Neg echo intrvl: 0 Neg detect mult: 5
Storage type: 2
Last sess down time: 00:00:00
Sess discontinue time: 00:00:00
Counters values:
Pkt In 00000000000007675 Pkt Out 00000000000007612
Echo Out 0000000000000000
IPv6 Pkt In 0000000000000000 IPv6 Pkt Out 0000000000000000
IPv6 Echo Out 0000000000000000
UP Count: 1 UPTIME: 00:09:37
NSM-> Client ID: 1 Flags: 4
Number of Sessions: 1
```

---

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---

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