

Brocade 5600 vRouter BFD Configuration Guide

Supporting Brocade 5600 vRouter 4.2R1

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Preface

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Document conventions

The document conventions describe text formatting conventions, command syntax conventions, and important notice formats used in Brocade technical documentation.

Text formatting conventions

Text formatting conventions such as boldface, italic, or Courier font may be used in the flow of the text to highlight specific words or phrases.

Format	Description
bold text	Identifies command names Identifies keywords and operands Identifies the names of user-manipulated GUI elements
<i>italic text</i>	Identifies text to enter at the GUI Identifies emphasis Identifies variables
Courier font	Identifies document titles Identifies CLI output Identifies command syntax examples

Command syntax conventions

Bold and italic text identify command syntax components. Delimiters and operators define groupings of parameters and their logical relationships.

Convention	Description
bold text	Identifies command names, keywords, and command options.
<i>italic text</i>	Identifies a variable.
value	In Fibre Channel products, a fixed value provided as input to a command option is printed in plain text, for example, --show WWN.
[]	Syntax components displayed within square brackets are optional.
{ x y z }	Default responses to system prompts are enclosed in square brackets. A choice of required parameters is enclosed in curly brackets separated by vertical bars. You must select one of the options.
x y	In Fibre Channel products, square brackets may be used instead for this purpose. A vertical bar separates mutually exclusive elements.
< >	Nonprinting characters, for example, passwords, are enclosed in angle brackets.

Convention	Description
...	Repeat the previous element, for example, <i>member{member...}</i> .
\	Indicates a "soft" line break in command examples. If a backslash separates two lines of a command input, enter the entire command at the prompt without the backslash.

Notes, cautions, and warnings

Notes, cautions, and warning statements may be used in this document. They are listed in the order of increasing severity of potential hazards.

NOTE

A Note provides a tip, guidance, or advice, emphasizes important information, or provides a reference to related information.

ATTENTION

An Attention statement indicates a stronger note, for example, to alert you when traffic might be interrupted or the device might reboot.



CAUTION

A Caution statement alerts you to situations that can be potentially hazardous to you or cause damage to hardware, firmware, software, or data.



DANGER

A Danger statement indicates conditions or situations that can be potentially lethal or extremely hazardous to you. Safety labels are also attached directly to products to warn of these conditions or situations.

Brocade resources

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You can download additional publications supporting your product at www.brocade.com. Select the Brocade Products tab to locate your product, then click the Brocade product name or image to open the individual product page. The user manuals are available in the resources module at the bottom of the page under the Documentation category.

To get up-to-the-minute information on Brocade products and resources, go to MyBrocade. You can register at no cost to obtain a user ID and password.

Release notes are available on MyBrocade under Product Downloads.

White papers, online demonstrations, and data sheets are available through the Brocade website.

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Preferred method of contact for non-urgent issues: <ul style="list-style-type: none"> • My Cases through MyBrocade • Software downloads and licensing tools • Knowledge Base 	Required for Sev 1-Critical and Sev 2-High issues: <ul style="list-style-type: none"> • Continental US: 1-800-752-8061 • Europe, Middle East, Africa, and Asia Pacific: +800-AT FIBREE (+800 28 34 27 33) • For areas unable to access toll free number: +1-408-333-6061 • Toll-free numbers are available in many countries. 	support@brocade.com Please include: <ul style="list-style-type: none"> • Problem summary • Serial number • Installation details • Environment description

Brocade OEM customers

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- OEM/Solution Providers are trained and certified by Brocade to support Brocade® products.
- Brocade provides backline support for issues that cannot be resolved by the OEM/Solution Provider.
- Brocade Supplemental Support augments your existing OEM support contract, providing direct access to Brocade expertise. For more information, contact Brocade or your OEM.
- For questions regarding service levels and response times, contact your OEM/Solution Provider.

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- Through the online feedback form in the HTML documents posted on www.brocade.com.
- By sending your feedback to documentation@brocade.com.

Provide the publication title, part number, and as much detail as possible, including the topic heading and page number if applicable, as well as your suggestions for improvement.

About This Guide

This guide describes how to run BFD on the Brocade vRouter (referred to as a virtual router, vRouter, or router in the guide).

Overview of BFD

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Understanding BFD

Bidirectional Forwarding Detection (BFD) is a simple control protocol that is used to detect faults between two forwarding systems that are connected by a link. BFD is comparable to the detection components of well-known routing protocols.

A requirement of networking solutions is the rapid detection of communication failures between adjacent systems to establish alternative paths quickly. The time-to-detect failure in existing protocols is no better than one second, which is far too long for some applications, and represents data loss at gigabit rates.

Consider two systems, R1 and R2, that already share a routing protocol such as BGP on a data plane interface named `dp0s7`. If we set up a BFD session between R1 and R2, R1 and R2 begin to transmit packets periodically over each path between the two systems. The control packets adhere to a previously agreed-upon frequency. If R1 stops receiving BFD packets for a specified time, some component in that particular bidirectional path to R2 is assumed to have failed. Under some conditions, R1 and R2 may negotiate not to send periodic BFD packets to reduce overhead. Thus, allows for fast systems on a shared medium with a slow system to rapidly detect failures between the fast while allowing the slow system to participate to the best of its ability.

FIGURE 1 An overview of BFD



BFD works with both peers that are connected directly and peers that are multiple hops away. No automatic discovery of BFD neighbors occurs; the sessions must be explicitly configured for each new system. For more information about BFD, refer to RFC 5880, *Bidirectional Forwarding Detection (BFD)*, at <https://tools.ietf.org/html/rfc5880>.

NOTE

BFD is a failure-detection mechanism only; the routing protocol is responsible for taking a failover action.

BFD operating modes

BFD can operate in any of three available modes: asynchronous, demand, and echo. The three BFD modes are described in the following paragraphs.

- Asynchronous mode—In this mode, the systems periodically send BFD control packets to one another, and if a number of those packets in a row are not received by the other system in a stipulated time, the session is declared to be down.
- Demand mode—In this mode, a system has an independent way of verifying that it has connectivity to the other system. After a BFD session is established, such a system may ask the other system to stop sending BFD control packets, except when the system detects the need to verify connectivity explicitly. In such a case, a short sequence of BFD control packets is exchanged. Demand mode may operate independently in each direction or simultaneously.
- Echo mode—In this mode, packets are transmitted and consumed by the originating system. This mode exercises the forwarding path of the remote end. Echo mode is used when more-aggressive intervals are required.

NOTE

Brocade supports only the asynchronous mode currently.

BFD timers

The BFD intervals for packet transmission, packet reception, and session detection are continuously negotiated; thus the intervals can change at any time. These intervals are referred to as BFD timers.

Both BFD nodes negotiate and converge on the same timer interval which is the higher of the two intervals. The detection time is independent in each direction as the multiplier can vary for each node.

The three modes of BFD have three types of BFD timers associated with them:

- Tx timer—Minimum time the system prefers to use for transmitting consecutive BFD packets
- Rx timer—Minimum time required by the receiving system to receive consecutive packets
- Echo Rx timer—Minimum time required by the transmitting system to receive consecutive echo packets
- Multiplier—Negotiated multiplier for the BFD session

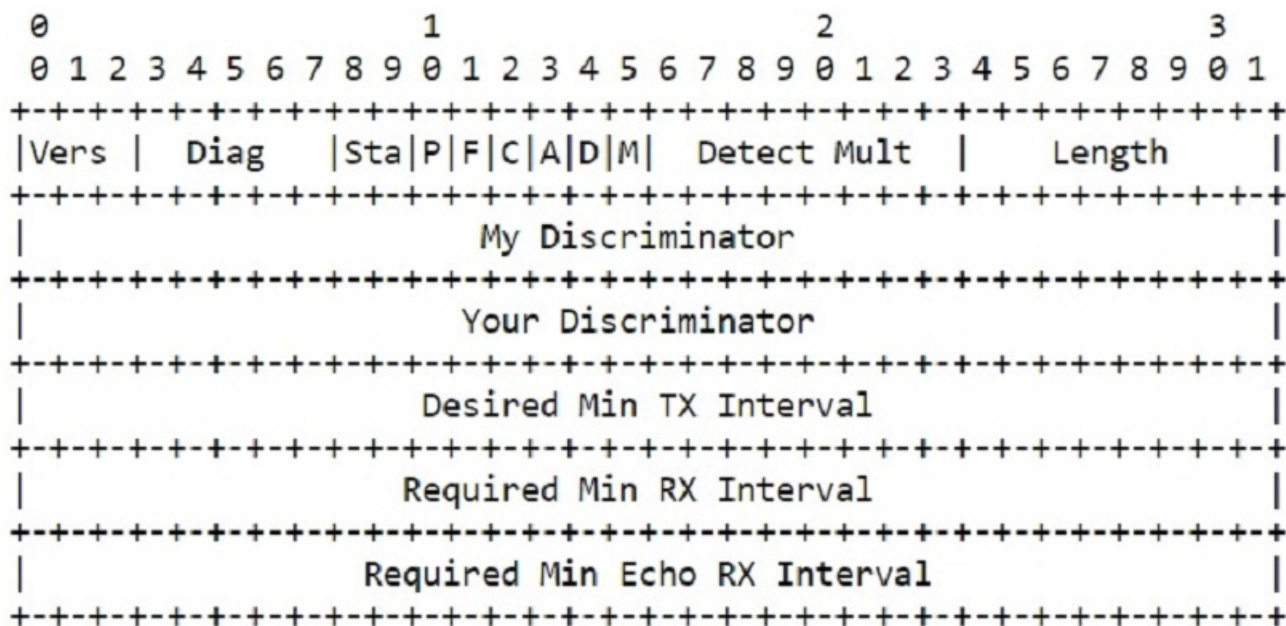
NOTE

Brocade does not support echo mode currently.

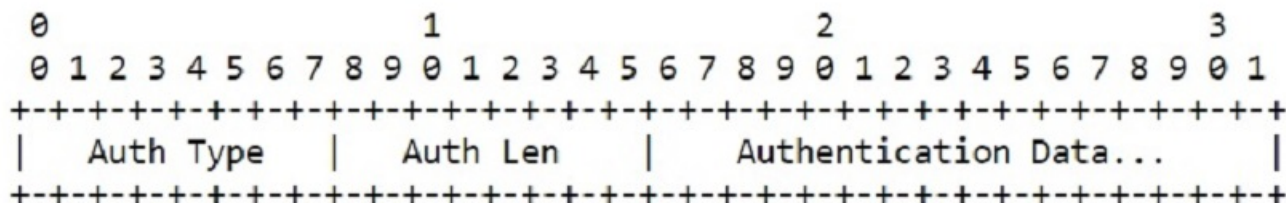
Format of a BFD control packet

A BFD control packet is sent in an encapsulation and the packet has a mandatory section and an optional authentication section. The format of the authentication section, if present, depends on the type of authentication in use.

FIGURE 2 Format of a BFD control packet



An optional Authentication Section MAY be present:



The preceding figure displays a cross-sectional view of the BFD control packet. The packet dividers are described here:

- Vers (Version)—Version of the BFD protocol.
- Diag (Diagnostics)—Diagnostic code that indicates the reason for the last change of the local system in a BFD session state.
- Sta (State)—State of the current BFD session as seen by the transmitting system.
- P (Poll)—Indication that the transmitting system is requesting verification of connectivity or a parameter change, and is expecting a packet with the Final (F) bit in reply. If not set, the transmitting system is not requesting verification.

- F (Final)—Indication that the transmitting system is responding to a received BFD control packet that has the Poll (P) bit set. If not set, the transmitting system is not responding to a Poll.
- C (Control Plane Independent)—Indication that the implementation of the BFD session of the transmitting system is independent of the control plane. If not set, the implementation of the BFD session of the transmitting system depends on the control plane.
- A (Authentication Present)—Indication that the session is to be authenticated. If not set, the session is not authenticated.
- D (Demand)—Indication that the demand mode is active in the transmitting system. In demand mode, the system recognizes that the session is active in both directions, and directs the remote system to halt the periodic transmission of BFD control packets. If not set, demand mode is not active in the transmitting system.
- M (Multipoint)—Indication that the bit is reserved for future point-to-multipoint extensions to BFD. It must be zero on both transmit and receipt.
- Detect Mult—Detection time multiplier. The negotiated transmission interval, multiplied by this value, provides the detection time for the receiving system in asynchronous mode.
- Length—Length of the BFD control packet, in bytes.
- My Discriminator—Unique, nonzero discriminator that is generated by the transmitting system, used to demultiplex multiple BFD sessions between the same pair of systems.
- Your Discriminator—Discriminator received from the corresponding remote system. This field reflects the received value of My Discriminator, or is zero if that value is unknown.
- Desired Min TX Interval—Minimum interval, in microseconds, that the local system prefers to use when transmitting BFD control packets.
- Required Min RX Interval—Minimum interval, in microseconds, between received BFD control packets that the system is capable of supporting.
- Required Min Echo RX Interval—Minimum interval, in microseconds, between received BFD echo packets that the system is capable of supporting.
- Auth Type—Authentication type in use, if the Authentication Present (A) bit is set.
- Auth Len—Length, in bytes, of the authentication section, including the Auth Type and Auth Len fields.
- Authentication Data—Information used to authenticate the BFD sessions.

BFD authentication

Authentication for BFD sessions is disabled by default. Brocade recommends the implementation of BFD authentication when you run BFD over multiple hops or through insecure tunnels.

The authentication section in the BFD control packet is optional. Based on the type of authentication, the receiving system determines the validity of the received packet. The receiving system either accepts the packet for further processing or discards it. For authentication to work, both systems in a BFD session must use the same authentication type, authentication keys, and so on.

BFD authentication algorithms include the following:

- Simple password
- Keyed MD5
- Meticulous keyed MD5
- Keyed SHA1
- Meticulous keyed SHA1

Simple password authentication involves one or more passwords with corresponding key IDs that are configured in each system that is running BFD. One pair of a password and a key ID is carried in each BFD control packet. The receiving system accepts the packet if the password-key ID pair matches a password-key ID pair configured in that system. The password is a binary character string, and is 1 to 16 bytes in length.

NOTE

Brocade supports simple password authentication currently.

Advantages of BFD

BFD was devised as a fault-detection mechanism because most modern routing protocols cannot detect failures in milliseconds (ms).

BFD has some other advantages as listed here:

- BFD is not tied to any particular routing protocol; it can be used as a generic and consistent failure-detection mechanism for all kinds of routing protocols.
- The periodic transmission and reception of BFD packets works from the data plane. It is less CPU intensive than routing protocols that exist only on the control plane.
- The timing of the BFD control packets can be adjusted dynamically to avoid the pitfalls of false failure messages.

Limitations of BFD for the Brocade vRouter

The current release of the Brocade vRouter has the following BFD limitations.

- Demand mode is not supported.
- BFD over LDP and over LAG are not supported.
- Echo mode is not supported.

The current release of the Brocade vRouter has the following BFD features:

- Protocols such as BGP, OSPFv2, OSPFv3, and static routes are supported.
- Both IPv4 and IPv6 addresses are supported.
- Both single hop and multiple hops are supported.
- The following parameters for BFD are supported:
 - minimum-rx interval
 - minimum-tx interval
 - detect-multiplier
 - simple password authentication

Basic BFD Configuration

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BFD workflow

Bidirectional Forwarding Detection (BFD) does not have a peer-discovery mechanism. You must configure BFD for each system.

NOTE

You must configure the routing protocol before configuring BFD. To configure the routing protocol, refer to the Brocade vRouter documentation for that particular routing protocol.

The following steps give an overview of the BFD workflow.

1. The routing protocol registers itself to BFD as a BFD client.
2. The BFD timers are negotiated between the two BFD peers by using the periodic exchange of packets.
3. The BFD session can go down due to an expiry of the BFD timer or due to a link going down. In such a case, BFD informs all its registered clients about the failure. The clients then take failover action.
4. The BFD control packets are exchanged until the BFD session is terminated due to the removal of a BFD client or the removal of the BFD configuration. In either case, the BFD session is torn down.

For more information on how to configure BFD, refer to the next sections in this chapter.

Configuring a BFD parameter template

Brocade provides a BFD parameter template that you can use to configure BFD for each client. You can create multiple BFD parameter templates and associate a BFD parameter template with a client to configure fall-over BFD.

The following list presents some important guidelines for configuring and assigning the BFD parameter template:

- Creating and associating the BFD parameter template is optional. If you do not specify a BFD parameter template while registering a client for BFD, the default values for `minimum-tx`, `minimum-rx`, and `detect-multiplier` are used. Authentication is disabled by default.
- You can associate the BFD parameter template with either a source and destination address template or an interface. As the BFD template can be associated with either a source and destination address template or an interface, note the following priority levels:
 - If the BFD parameter template is associated with a source and destination address template, it has first priority.
 - If the BFD parameter template is associated with an interface, it has second priority.

NOTE

Associating a BFD parameter template with an interface is supported for single-hop BFD sessions only.

- Instead of specifying the source IP address in the BFD configuration command, you can also use the `source any` parameter to associate the BFD parameter template with all BFD sessions that have the specific destination. For more information, refer to [BFD Commands](#) on page 61.

- For OSPFv3 configurations, you must specify the link local addresses for source and destination in the BFD parameter template association command instead of the interface addresses or loopback addresses. For more information, refer to an example in [Configuring BFD for OSPFv3 on a physical interface by using IPv6 addressing](#) on page 52.
- If the parameter template is not specified, minimum-tx is taken as 300, minimum-rx is taken as 300, and the multiplier is taken as 3.

Configuring with a source and destination address template

You can configure the BFD parameter template with the source and destination address template for a BFD session.

Consider two systems, R1 and R2, that already share a routing protocol such as BGP on a data plane interface named `dp0s7`. The following table provides a list of steps to configure the BFD parameter template and associate it with a source and destination address template on the R1 router.

FIGURE 3 Configuring with a source and destination address template



TABLE 1 Configuring with a source and destination address template

Router	Step	Command
R1	Specify a BFD parameter template name.	<code>vyatta@R1# set protocols bfd template test</code>
R1	Set the minimum-tx value.	<code>vyatta@R1# set protocols bfd template test minimum-tx 300</code>
R1	Set the minimum-rx value.	<code>vyatta@R1# set protocols bfd template test minimum-rx 300</code>
R1	Set the detect-multiplier value.	<code>vyatta@R1# set protocols bfd template test multiplier 3</code>
R1	Set the authentication type and associate a key with the authentication type.	<code>vyatta@R1# set protocols bfd template test auth simple key brocade</code>
R1	Commit the configuration.	<code>vyatta@R1# commit</code>
R1	Save the configuration.	<code>vyatta@R1# save</code>
R1	Display the values of the BFD parameter template.	<pre>vyatta@R1# show protocols bfd bfd { template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>

TABLE 1 Configuring with a source and destination address template (continued)

Router	Step	Command
		<pre> } } } } } } </pre>
R1	Assign the template for all BFD sessions with the destination as R2 and the source as R1.	<pre> vyatta@R1# set protocols bfd destination 10.10.10.2 source 10.10.10.1 template test </pre>
R1	Commit the configuration.	<pre> vyatta@R1# commit </pre>
R1	Save the configuration.	<pre> vyatta@R1# save </pre>
R1	Display the configuration.	<pre> vyatta@R1# show protocols bfd bfd { destination 10.10.10.2 { source 10.10.10.1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

Configuring with an interface

You can configure the BFD parameter template with the interface on which the BFD session is running. This method applies to single-hop BFD sessions only.

Consider two systems, R1 and R2, that already share a routing protocol such as BGP on a data plane interface named `dp0s7`. The following table provides a list of steps to associate a BFD template with an interface on the R1 router.

FIGURE 4 Configuring with an interface**TABLE 2** Configuring with an interface

Router	Step	Command
R1	Specify a BFD parameter template name.	<pre> vyatta@R1# set protocols bfd template test </pre>

TABLE 2 Configuring with an interface (continued)

Router	Step	Command
R1	Set the minimum-tx value.	<code>vyatta@R1# set protocols bfd template test minimum-tx 300</code>
R1	Set the minimum-rx value	<code>vyatta@R1# set protocols bfd template test minimum-rx 300</code>
R1	Set the detect-multiplier value.	<code>vyatta@R1# set protocols bfd template test multiplier 3</code>
R1	Set the authentication type and associate a key with the authentication type.	<code>vyatta@R1# set protocols bfd template test auth simple key brocade</code>
R1	Commit the configuration.	<code>vyatta@R1# commit</code>
R1	Save the configuration.	<code>vyatta@R1# save</code>
R1	Display the values of the BFD parameter template.	<pre>vyatta@R1# show protocols bfd bfd { template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>
R1	Assign the template for all BFD sessions with the destination as R2 and the source as R1.	<code>vyatta@R1# set interface dataplane dp0s7 bfd template test</code>
R1	Commit the configuration.	<code>vyatta@R1# commit</code>
R1	Save the configuration.	<code>vyatta@R1# save</code>
R1	Display the configuration.	<pre>vyatta@R1# show protocols bfd bfd { dataplane dp0s7 { template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } }</pre>

Configuring BFD by Using IPv4 Addressing

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Configuring BFD for BGP

This section describes the procedure for configuring BFD for BGP single hop and multiple hop, so that BGP is a registered protocol with BFD and receives detection-failure messages about the forwarding path. Implementing BFD for BGP results in fast convergence timings.

NOTE

BFD is supported for both iBGP and eBGP. All these configurations are for BFD over iBGP. For BFD over eBGP, remote-as (asn) can be modified with remote system (asn) for both single-hop and multiple-hop BFD. The eBGP multiple-hop (hopcount) is configured with the required hop count for eBGP multiple-hop BFD.

NOTE

BFD for BGP is supported for both IPv4 and IPv6 addressing.

Configuring BFD for BGP single hop by using IPv4 addressing

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share a BGP session, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 loopback address—1.1.1.1
- R1 interface address facing R2—10.10.10.1
- R2 loopback address—2.2.2.2
- R2 interface address facing R1—10.10.10.2
- Data plane interface name—dp0s7

FIGURE 5 Configuring BFD for BGP single hop by using IPv4 addressing



To configure BFD for BGP single hop by using IPv4 addressing, perform the following steps in configuration mode.

TABLE 3 Configuring BFD for BGP Single Hop by Using IPv4 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1. NOTE You can also associate the BFD parameter template with the interface by using the <code>set interface dataplane <if_name> bfd template <template_name></code> command.	<pre>vyatta@R1#set protocols bfd destination 10.10.10.2 source 10.10.10.1 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set protocols bgp 100 neighbor 10.10.10.2 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols bgp bgp 100 { neighbor 10.10.10.2 { address-family { ipv4-unicast } fall-over { bfd } remote-as 100 } } vyatta@R1#show protocols bfd bfd { destination 10.10.10.2 { source 10.10.10.1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>
R2	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R2.	<pre>vyatta@R2#set protocols bfd destination 10.10.10.1 source 10.10.10.2 template test</pre>

TABLE 3 Configuring BFD for BGP Single Hop by Using IPv4 Addressing (continued)

Router	Step	Command
	<p>NOTE</p> <p>You can also associate the BFD parameter template with the interface by using the set interface dataplane <if_name> bfd template <template_name> command.</p>	
R2	Register R1 as a BFD neighbor.	<code>vyatta@R2#set protocols bgp 100 neighbor 10.10.10.1 fall-over bfd</code>
R2	Commit the configuration.	<code>vyatta@R2#commit</code>
R2	Save the configuration.	<code>vyatta@R2#save</code>
R2	Display the configuration.	<pre>vyatta@R2#show protocols bgp bgp 100 { neighbor 10.10.10.1 { address-family { ipv4-unicast } fall-over { bfd } remote-as 100 } } vyatta@R2#show protocols bfd bfd { destination 10.10.10.1 { source 10.10.10.2 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

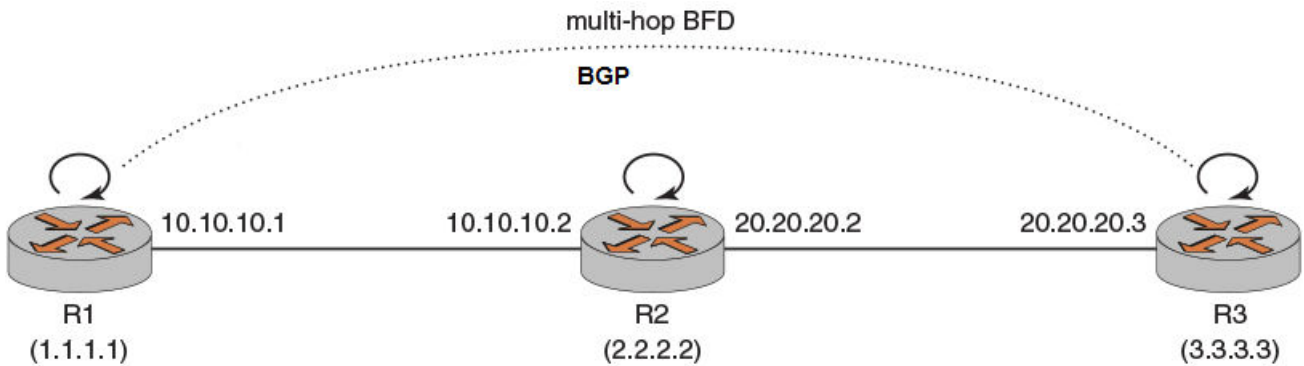
Configuring BFD for BGP multiple hop by using IPv4 addressing

Consider a scenario in which you have three systems, R1, R2, and R3. R1 and R3 share a BGP session. The following list provides the addresses of R1, R2, and R3.

- R1 loopback address—1.1.1.1
- R1 interface address facing R2—10.10.10.1

- R2 loopback address—2.2.2.2
- R2 interface address facing R1—10.10.10.2
- R2 interface address facing R3—20.20.20.2
- R3 interface address facing R2—20.20.20.3
- R3 loopback address—3.3.3.3

FIGURE 6 Configuring BFD for BGP multiple hop by using IPv4 addressing



To configure a multiple-hop BFD session between R1 and R3, perform the following steps in configuration mode.

TABLE 4 Configuring BFD for BGP Multiple Hop by Using IPv4 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R3 and the source address of R1.	<code>vyatta@R1#set protocols bfd destination 20.20.20.3 source 10.10.10.1 template test</code>
R1	Register R3 as a BFD neighbor.	<code>vyatta@R1#set protocols bgp 100 neighbor 20.20.20.3 fall-over bfd</code>
R1	Commit the configuration.	<code>vyatta@R1#commit</code>
R1	Save the configuration.	<code>vyatta@R1#save</code>
R1	Display the configuration.	<pre>vyatta@R1#show protocols bgp bgp 100 { neighbor 20.20.20.3 { fall-over { bfd } } remote-as 100 } vyatta@R1#show protocols bfd bfd { destination 20.20.20.3 { source 10.10.10.1 { template test } } }</pre>

TABLE 4 Configuring BFD for BGP Multiple Hop by Using IPv4 Addressing (continued)

Router	Step	Command
		<pre> } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>
R3	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R3	Associate the BFD test template with the destination address of R1 and the source address of R3.	<pre> vyatta@R3#set protocols bfd destination 10.10.10.1 source 20.20.20.3 template test </pre>
R3	Register R1 as a BFD neighbor.	<pre> vyatta@R3#set protocols bgp 100 neighbor 10.10.10.1 fall-over bfd </pre>
R3	Commit the configuration.	<pre> vyatta@R3#commit </pre>
R3	Save the configuration.	<pre> vyatta@R3#save </pre>
R3	Display the configuration.	<pre> vyatta@R3#show protocols bgp bgp 100 { neighbor 10.10.10.1 { fall-over { bfd } remote-as 100 } } vyatta@R3#show protocols bfd bfd { destination 10.10.10.1 { source 20.20.20.3 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

Configuring BFD for static routes

To configure BFD for static routes by using IPv4 and IPv6 addressing, you must first set up the static route between the two peer systems.

If a static route exists between two nodes, BFD must be configured on both nodes. The static route is enabled and made available for use only when BFD is in the up state; otherwise, the static route is inactive. BFD for static routes is available for both single hop and multiple hops.

No keyword exists in the Vyatta CLI to configure BFD multiple-hop sessions, although multiple-hop sessions are supported. A BFD session is set up either in single-hop or multiple-hop mode based on the next-hop reachability from the source system. If the next hop for the destination is directly connected, BFD comes up as a single-hop session, and, if it is recursively reachable, BFD is set up as a multiple-hop session.

Configuring BFD for static routes single hop by using IPv4 addressing

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share a static route session, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 loopback address—1.1.1.1/32
- R1 interface address—10.10.10.1/24
- R2 loopback address—2.2.2.2/32
- R2 interface address—10.10.10.2/24

FIGURE 7 Configuring BFD for static routes single hop by using IPv4 addressing



To configure a BFD session between R1 and R2, perform the following steps in configuration mode.

TABLE 5 Configuring BFD for Static Routes Single Hop by Using IPv4 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1.	<code>vyatta@R1#set protocols bfd destination 10.10.10.2 source 10.10.10.1 template test</code>
R1	Register R2 as a BFD neighbor.	<code>vyatta@R1#set protocols static route 2.2.2.2/32 next-hop 10.10.10.2 fall-over bfd</code>
R1	Commit the configuration.	<code>vyatta@R1#commit</code>

TABLE 5 Configuring BFD for Static Routes Single Hop by Using IPv4 Addressing (continued)

Router	Step	Command
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols static static { route 2.2.2.2/32 { next-hop 10.10.10.2 { fall-over { bfd } } } } vyatta@R1#show protocols bfd bfd { destination 10.10.10.2 { source 10.10.10.1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>
R2	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD test template with the destination address of R1 and the source address of R2.	<pre>vyatta@R2#set protocols bfd destination 10.10.10.1 source 10.10.10.2 template test</pre>
R2	Register R1 as a BFD neighbor.	<pre>vyatta@R2#set protocols static route 1.1.1.1/32 next-hop 10.10.10.1 fall-over bfd</pre>
R2	Commit the configuration.	<pre>vyatta@R2#commit</pre>
R2	Save the configuration.	<pre>vyatta@R2#save</pre>
R2	Display the configuration.	<pre>vyatta@R2#show protocols static static { route 1.1.1.1/32 { next-hop 10.10.10.1 { fall-over { bfd } } } } vyatta@R2#show protocols bfd bfd { destination 10.10.10.1 { source 10.10.10.2 {</pre>

TABLE 5 Configuring BFD for Static Routes Single Hop by Using IPv4 Addressing (continued)

Router	Step	Command
		<pre> template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

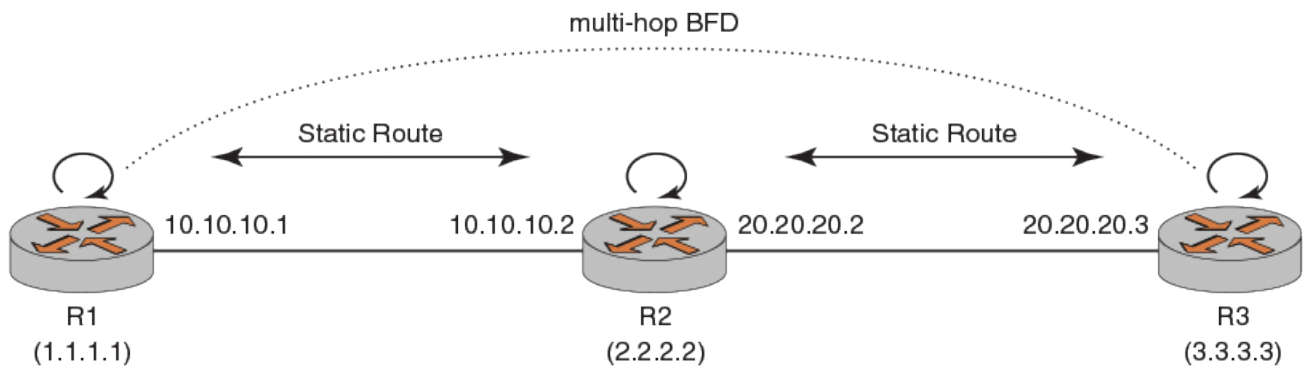
Configuring BFD for static routes multiple hop by using IPv4 addressing

To configure BFD multiple hop for static routes, you must first set up the static route between the two peer systems.

Consider a scenario in which you have three systems R1, R2, and R3. R1 and R2 share a static route, and R2 and R3 share a static route. The following list provides the addresses of R1, R2, and R3.

- R1 loopback address—1.1.1.1/32
- R1 interface address facing R2—10.10.10.1/24
- R2 loopback address—2.2.2.2/32
- R2 interface address facing R1—10.10.10.2/24
- R2 interface address facing R3—20.20.20.2/24
- R3 interface address facing R2—20.20.20.3/24
- R3 loopback address—3.3.3.3/32

FIGURE 8 Configuring BFD for static routes multiple hop by using IPv4 addressing



To configure a BFD session between R1 and R3, perform the following steps in configuration mode.

TABLE 6 Configuring BFD for Static Routes Multiple Hop by Using IPv4 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R3 and the source address of R1.	<pre>vyatta@R1# set protocols bfd destination 20.20.20.3 source 10.10.10.1 template test</pre>
R1	Register R3 as a BFD neighbor.	<pre>vyatta@R1# set protocols static route 3.3.3.3/32 next-hop 20.20.20.3 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1# commit</pre>
R1	Save the configuration.	<pre>vyatta@R1# save</pre>
R1	Display the configuration.	<pre>vyatta@R1# show protocols static static { route 3.3.3.3/32 { next-hop 20.20.20.3 { fall-over { bfd } } } } vyatta@R1# show protocols bfd bfd { destination 20.20.20.3 { source 10.10.10.1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>
R3	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R3	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R3.	<pre>vyatta@R3# set protocols bfd destination 10.10.10.1 source 20.20.20.3 template test</pre>
R3	Register R1 as a BFD neighbor.	<pre>vyatta@R3# set protocols static route 1.1.1.1/32 next-hop 10.10.10.1 fall-over bfd</pre>
R3	Commit the configuration.	<pre>vyatta@R3# commit</pre>
R3	Save the configuration.	<pre>vyatta@R3# save</pre>
R3	Display the configuration.	<pre>vyatta@R3# show protocols static static { route 1.1.1.1/32 { next-hop 10.10.10.1 { </pre>

TABLE 6 Configuring BFD for Static Routes Multiple Hop by Using IPv4 Addressing (continued)

Router	Step	Command
		<pre> fall-over { bfd } } } } vyatta@R3# show protocols bfd bfd { destination 10.10.10.1 { source 20.20.20.3 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

Configuring a BFD helper session by using IPv4 addressing

You can configure a static route from a router R1 to another router R2, without configuring another static route from R2 to R1. In such a case, you can enable BFD only from R1 to R2 with static route as the client. BFD must be configured at both routers for it to be operational, you can use a helper session to compensate the lack of a static route from R2 to R1.

Consider two routers R1 and R2. There is a static route from R2 to R1, and but no static route from R1 to R2. You can enable BFD for R1.

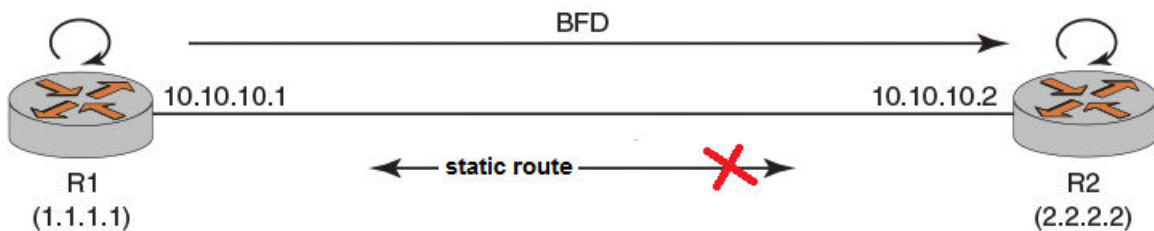
NOTE

The `source any` parameter is not supported for the helper session command.

The helper session is supported for both IPv4 and IPv6 addresses. The following list provides the addresses of R1 and R2.

- R1 interface address facing R2—10.10.10.1
- R2 interface address facing R1—10.10.10.2

FIGURE 9 Configuring a BFD helper session by using IPV4 addressing



To configure BFD by using a helper session, perform the following steps in configuration mode.

NOTE

Instead of specifying the source IP address in this example, you can also use the `source any` parameter to associate the BFD template with all BFD sessions that have the specific destination. For more information, refer to [BFD Commands](#) on page 61.

TABLE 7 Configuring a BFD Helper Session by Using IPV4 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1.	<pre>vyatta@R1#set protocols bfd destination 10.10.10.2 source 10.10.10.1 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set protocols bfd destination 10.10.10.2 source 10.10.10.1 helper-session</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols bfd protocols { bfd { destination 10.10.10.2 { source 10.10.10.1 { template test helper-session } } } minimum-rx 300 minimum-tx 300 multiplier 3 }</pre>

Configuring BFD for OSPFv2

BFD for OSPFv2 is supported for physical interfaces, virtual interfaces, and virtual links. OSPFv2 uses IPv4 addressing.

Configuring BFD for OSPFv2 on a physical interface by using IPv4 addressing

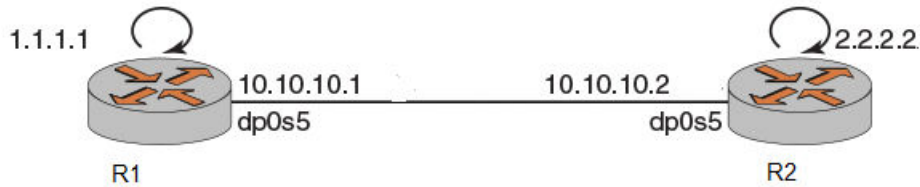
To configure BFD for all OSPFv2 neighbors on a physical interface, you must first configure OSPFv2 for all the neighbors.

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share an OSPFv2 session, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 loopback address—1.1.1.1
- R1 interface address—10.10.10.1
- R2 loopback address—2.2.2.2
- R2 interface address—10.10.10.2.

- R1 and R2 connected physical interface—dp0s5

FIGURE 10 Configuring BFD for OSPFv2 on a physical interface by using IPv4 addressing



To configure a BFD session between R1 and R2, perform the following steps in configuration mode. BFD for OSPFv2 is configured on the physical interface.

TABLE 8 Configuring BFD for OSPFv2 on a Physical Interface by Using IPv4 Addressing

Router	Step	Command
R1	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD test template with the destination address of R2 and the source address of R1. NOTE You can also associate the BFD parameter template with the interface by using the set interface dataplane <if_name> bfd template <template_name> command.	<pre>vyatta@R1#set protocols bfd destination 10.10.10.2 source 10.10.10.1 template test</pre>
R1	Start a BFD instance on the interface.	<pre>vyatta@R1# set interface dataplane dp0s5 ip ospf fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show interfaces interfaces { dataplane dp0s5 { address dhcp } dataplane dp0s5 { address 10.10.10.1 ip { ospf { fall-over { bfd } } } } }</pre>

TABLE 8 Configuring BFD for OSPFv2 on a Physical Interface by Using IPv4 Addressing (continued)

Router	Step	Command
		<pre> } } } vyatta@R1#show protocols bfd bfd { destination 10.10.10.2 { source 10.10.10.1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>
R2	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD test template with the destination address of R1 and the source address of R2. NOTE You can also associate the BFD parameter template with the interface by using the set interface dataplane <if_name> bfd template <template_name> command.	<pre> vyatta@R2#set protocols bfd destination 10.10.10.1 source 10.10.10.2 template test </pre>
R2	Commit the configuration.	<pre> vyatta@R2#commit </pre>
R2	Save the configuration.	<pre> vyatta@R2#save </pre>
R2	Display the configuration.	<pre> vyatta@R2#show interfaces interfaces { dataplane dp0s5 { address dhcp } dataplane dp0s5 { address 10.10.10.2 ip { ospf { fall-over { bfd } } } } } </pre>

TABLE 8 Configuring BFD for OSPFv2 on a Physical Interface by Using IPv4 Addressing (continued)

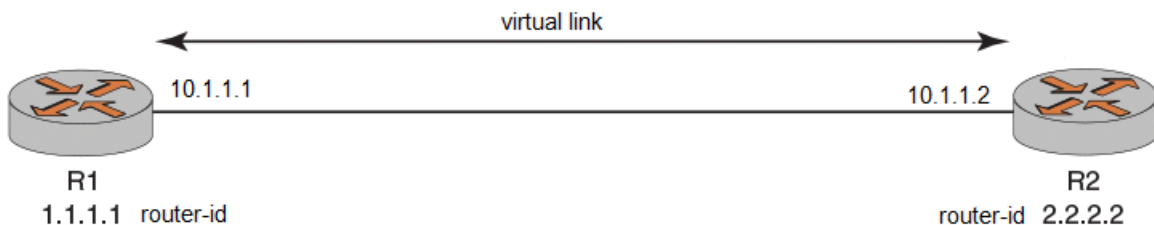
Router	Step	Command
		<pre> } } vyatta@R2#show protocols bfd bfd { destination 10.10.10.1 { source 10.10.10.2 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

Configuring BFD for OSPFv2 on a virtual link by using IPv4 addressing

To configure BFD for OSPFv2 neighbors on a virtual link, you must first configure the virtual link between the disconnected backbone area routers and then enable BFD on the virtual link.

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share an OSPFv2 session, sharing a virtual link, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 router-id—1.1.1.1
- R2 router-id—2.2.2.2
- R1 interface address facing R2—10.1.1.1
- R2 interface address facing R1—10.1.1.2

FIGURE 11 Configuring BFD for OSPFv2 on a virtual link by using IPv4 addressing

Virtual link is configured in a transit area. A virtual link chooses any address to reach other virtual link end points in the same transit area. Therefore, the source and destination addresses in a three-router configuration or a more-complex configuration are selected dynamically. You must ensure that you select the correct source and destination addresses for your BFD commands for OSPFv2 and OSPFv3 virtual links. To configure a BFD session between R1 and R2, perform the following steps in configuration mode.

TABLE 9 Configuring BFD for OSPFv2 on a Virtual Link by Using IPv4 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1.	<pre>vyatta@R1#set protocols bfd destination 10.1.1.2 source 10.1.1.1 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set protocols ospf area 1 virtual-link 2.2.2.2 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols ospf ospf { area 1 { network 10.1.1.0/24 virtual-link 2.2.2.2 { fall-over { bfd } } } parameters { router-id 1.1.1.1 } } vyatta@R1#show protocols bfd bfd { destination 10.1.1.2 { source 10.1.1.1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>
R2	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R2.	<pre>vyatta@R2#set protocols bfd destination 10.1.1.1 source 10.1.1.2 template test</pre>
R2	Register R1 as a BFD neighbor.	<pre>vyatta@R2#set protocols ospf area 1 virtual-link 1.1.1.1 fall-over bfd</pre>
R2	Commit the configuration.	<pre>vyatta@R2#commit</pre>
R2	Save the configuration.	<pre>vyatta@R2#save</pre>
R2	Display the configuration.	<pre>vyatta@R2#show protocols ospf ospf {</pre>

TABLE 9 Configuring BFD for OSPFv2 on a Virtual Link by Using IPv4 Addressing (continued)

Router	Step	Command
		<pre> area 1 { network 10.1.1.0/24 virtual-link 1.1.1.1 { fall-over { bfd } } } parameters { router-id 2.2.2.2 } } vyatta@R2#show protocols bfd bfd { destination 10.1.1.1 { source 10.1.1.2 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

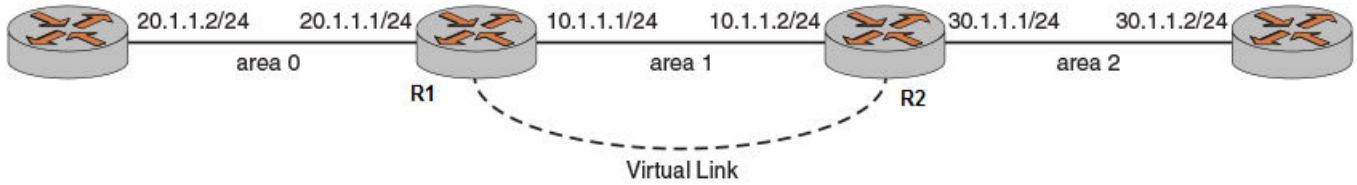
Configuring BFD for OSPFv2 on a virtual interface by using IPv4 addressing

To configure BFD for OSPFv2 neighbors on a virtual interface (VIF), you must first configure the OSPF and VIF for the two neighbors.

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share an OSPFv2 session. R1 and R2 are on a physical interface named dpOs5 which also has a virtual interface configured for the VLAN identifier of v1an-51. The following list provides the addresses of R1 and R2.

- R1 loopback address—1.1.1.1/32
- Physical data plane address—dp0s5
- Virtual link between R1 and R2—vif 51
- VLAN identifier—v1an-51
- R1 interface facing vif 51—10.1.1.1/24
- R2 interface facing vif 51—10.1.1.2/24
- R2 loopback address—2.2.2.2/32

FIGURE 12 Configuring BFD for OSPFv2 on a virtual interface by using IPv4 addressing



To configure a BFD session between R1 and R2, perform the following steps in configuration mode.

TABLE 10 Configuring BFD for OSPFv2 on a Virtual Interface by Using IPv4 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1. NOTE You can also associate the BFD parameter template with the interface by using the <code>set interface dataplane vif <vif_id> bfd template <template-name></code> command.	<pre>vyatta@R1#set protocols bfd destination 10.1.1.2 source 10.1.1.1 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set interfaces dataplane dp0s4 vif 51 ip ospf fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show interfaces interfaces { vif 51 { address 10.1.1.1/24 ip { ospf { fall-over { bfd } } } vlan 51 } } loopback lo { address 1.1.1.1/32 }</pre>

TABLE 10 Configuring BFD for OSPFv2 on a Virtual Interface by Using IPv4 Addressing (continued)

Router	Step	Command
		<pre> } vyatta@R1#show protocols protocols { bfd { destination 10.1.1.2 { source 10.1.1.1 { template test } } template test{ auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } ospf { area 0 { network 30.30.30.0/24 } redistribute { connected } } } </pre>
R2	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R2. <p>NOTE You can also associate the BFD parameter template with the interface by using the <code>set interface dataplane vif <vf_id> bfd template <template-name></code> command.</p>	<pre> vyatta@R2#set protocols bfd destination 10.1.1.1 source 10.1.1.2 template test </pre>
R2	Register R1 as a BFD neighbor.	<pre> vyatta@R2#set interfaces dataplane dp0s4 vif 51 ip ospf fall-over bfd </pre>
R2	Commit the configuration.	<pre> vyatta@R2#commit </pre>
R2	Save the configuration.	<pre> vyatta@R2#save </pre>
R2	Display the configuration.	<pre> vyatta@R2#show interfaces interfaces { vif 51 { </pre>

TABLE 10 Configuring BFD for OSPFv2 on a Virtual Interface by Using IPv4 Addressing (continued)

Router	Step	Command
		<pre> address 10.1.1.2/24 ip { ospf { fall-over { bfd } } } vlan 51 } loopback lo { address 2.2.2.2/32 } vyatta@R2#show protocols protocols { bfd { destination 10.1.1.1 { source 10.1.1.2 { template test } } template test{ auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } ospf { area 0 { network 30.30.30.0/24 } redistribute { connected } } } </pre>

Configuring BFD by Using IPv6 Addressing

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Configuring BFD for BGP

This section describes the procedure for configuring BFD for BGP single hop and multiple hop, so that BGP is a registered protocol with BFD and receives detection-failure messages about the forwarding path. Implementing BFD for BGP results in fast convergence timings.

NOTE

BFD is supported for both iBGP and eBGP. All these configurations are for BFD over iBGP. For BFD over eBGP, remote-as (asn) can be modified with remote system (asn) for both single-hop and multiple-hop BFD. The eBGP multiple-hop (hopcount) is configured with the required hop count for eBGP multiple-hop BFD.

NOTE

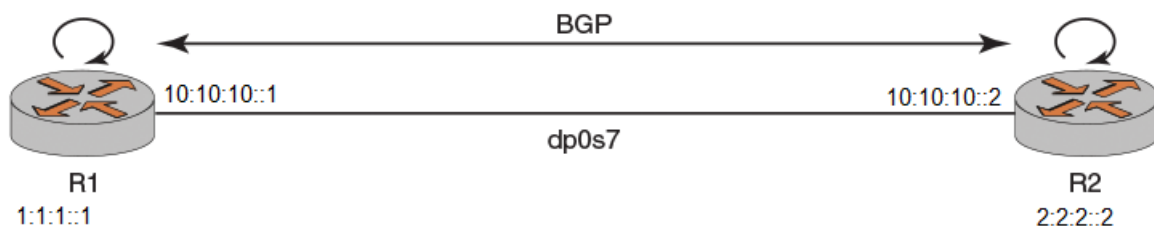
BFD for BGP is supported for both IPv4 and IPv6 addressing.

Configuring BFD for BGP single hop by using IPv6 addressing

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share a BGP session, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 loopback address—1:1:1::1
- R1 interface address facing R2—10:10:10::1
- R2 loopback address—2:2:2::2
- R2 interface address facing R1—10:10:10::2
- Data plane interface name—dp0s7

FIGURE 13 Configuring BFD for BGP single hop by using IPv6 addressing



To configure BFD for BGP single hop by using IPv6 addressing, perform the following steps in configuration mode.

TABLE 11 Configuring BFD for BGP Single Hop by Using IPv6 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1. NOTE You can also associate the BFD parameter template with the interface by using the <code>set interface dataplane <if_name> bfd template <template_name></code> command.	<pre>vyatta@R1#set protocols bfd destination 10:10:10::2 source 10:10:10::1 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set protocols bgp 100 neighbor 10:10:10::2 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols bgp bgp 100 { neighbor 10:10:10::2 { address-family { ipv6-unicast } fall-over { bfd } remote-as 100 } } vyatta@R1#show protocols bfd bfd { destination 10:10:10::2 { source 10:10:10::1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>
R2	Create a BFD template called <code>test</code> .	See section Configuring the BFD template .

TABLE 11 Configuring BFD for BGP Single Hop by Using IPv6 Addressing (continued)

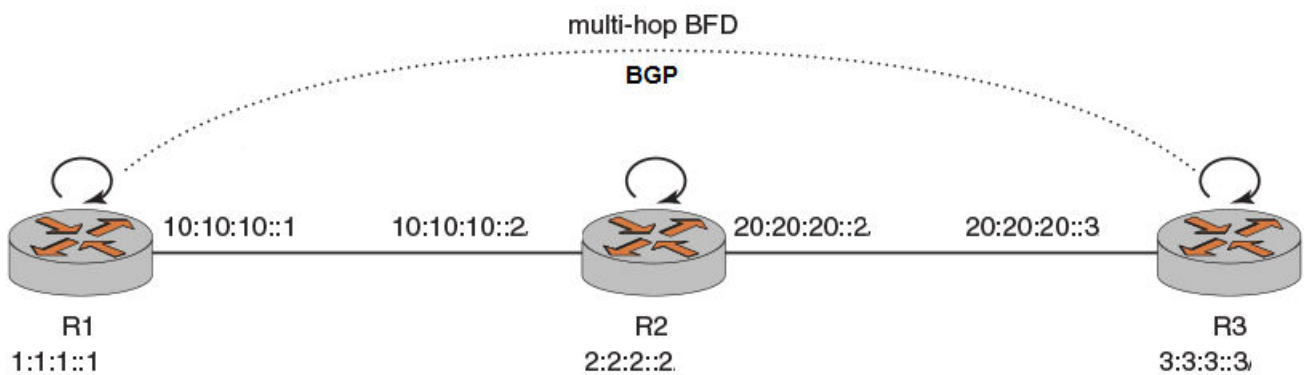
Router	Step	Command
R2	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R2. NOTE You can also associate the BFD parameter template with the interface by using the <code>set interface dataplane <if_name> bfd template <template_name></code> command.	<pre>vyatta@R2#set protocols bfd destination 10:10:10::1 source 10:10:10::2 template test</pre>
R2	Register R1 as a BFD neighbor.	<pre>vyatta@R2#set protocols bgp 100 neighbor 10:10:10::1 fall-over bfd</pre>
R2	Commit the configuration.	<pre>vyatta@R2#commit</pre>
R2	Save the configuration.	<pre>vyatta@R2#save</pre>
R2	Display the configuration.	<pre>vyatta@R2# show protocols bgp bgp 100 { neighbor 10:10:10::1 { address-family { ipv6-unicast } fall-over { bfd } remote-as 100 } } vyatta@R2#show protocols bfd bfd { destination 10:10:10::1 { source 10:10:10::2 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>

Configuring BFD for BGP multiple hop by using IPv6 addressing

Consider a scenario in which you have three systems, R1, R2, and R3. R1 and R3 share a multiple-hop BGP session, as illustrated in the reference network diagram. The following list provides the addresses of R1, R2, and R3.

- R1 loopback address—1:1:1::1
- R1 interface address facing R2—10:10:10::1
- R2 loopback address—2:2:2::2
- R2 interface address facing R1—10:10:10::2
- R2 interface address facing R3—20:20:20::2
- R3 interface address facing R2—20:20:20::3
- R3 loopback address—3:3:3::3

FIGURE 14 Configuring BFD for BGP multiple hop by using IPv6 addressing



To configure a multiple-hop BFD session between R1 and R3, perform the following steps in configuration mode.

TABLE 12 Configuring BFD for BGP Multiple Hop by Using IPv6 Addressing

Router	Step	Command
R1	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD test template with the destination address of R3 and the source address of R1.	<pre>vyatta@R1#set protocols bfd destination 20:20:20::3 source 10:10:10::1 template test</pre>
R1	Register R3 as a BFD neighbor.	<pre>vyatta@R1#set protocols bgp 100 neighbor 20:20:20::3 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols bgp bgp 100 { neighbor 20:20:20::3 { fall-over { bfd } } remote-as 100 }</pre>

TABLE 12 Configuring BFD for BGP Multiple Hop by Using IPv6 Addressing (continued)

Router	Step	Command
		<pre> } } vyatta@R1#show protocols bfd bfd { destination 20:20:20::3 { source 10:10:10::1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>
R3	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R3	Associate the BFD test template with the destination address of R1 and the source address of R3.	<pre> vyatta@R3#set protocols bfd destination 10:10:10::1 source 20:20:20::3 template test </pre>
R3	Register R1 as a BFD neighbor.	<pre> vyatta@R3#set protocols bgp 100 neighbor 10:10:10::1 fall-over bfd </pre>
R3	Commit the configuration.	<pre> vyatta@R3#commit </pre>
R3	Save the configuration.	<pre> vyatta@R3#save </pre>
R3	Display the configuration.	<pre> vyatta@R3#show protocols bgp bgp 100 { neighbor 10:10:10::1 { fall-over { bfd } remote-as 100 } } vyatta@R3#show protocols bfd bfd { destination 10:10:10::1 { source 20:20:20::3 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

TABLE 12 Configuring BFD for BGP Multiple Hop by Using IPv6 Addressing (continued)

Router	Step	Command
		}
		}

Configuring BFD for static routes

To configure BFD for static routes by using IPv4 and IPv6 addressing, you must first set up the static route between the two peer systems.

If a static route exists between two nodes, BFD must be configured on both nodes. The static route is enabled and made available for use only when BFD is in the up state; otherwise, the static route is inactive. BFD for static routes is available for both single hop and multiple hops.

No keyword exists in the Vyatta CLI to configure BFD multiple-hop sessions, although multiple-hop sessions are supported. A BFD session is set up either in single-hop or multiple-hop mode based on the next-hop reachability from the source system. If the next hop for the destination is directly connected, BFD comes up as a single-hop session, and, if it is recursively reachable, BFD is set up as a multiple-hop session.

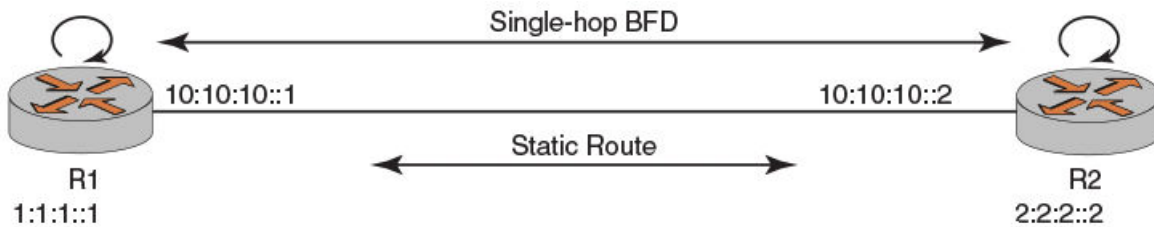
Configuring BFD for static route single hop by using IPv6 addressing

To configure BFD single hop by using IPv6 addressing, you must first set up a supported routing protocol between the two peer systems.

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share static route, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 loopback address—1:1:1::1/128
- R1 interface address—10:10:10::1/64
- R2 loopback address—2:2:2::2/128
- R2 interface address—10:10:10::2/64

FIGURE 15 Configuring BFD for static route single hop by using IPv6 addressing



To configure a BFD session between R1 and R2, perform the following steps in configuration mode.

TABLE 13 Configuring BFD for Static Route Single Hop by Using IPv6 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R2.	<pre>vyatta@R1#set protocols bfd destination 10:10:10::2 source 10:10:10::1 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set protocols static route6 2:2:2::2/128 next-hop 10:10:10::2 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols static route6 static { route6 2:2:2::2/128 { next-hop 10:10:10::2 { fall-over { bfd } } } } vyatta@R1#show protocols bfd bfd { destination 10:10:10::2 { source 10:10:10::1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>
R2	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1.	<pre>vyatta@R2#set protocols bfd destination 10:10:10::1 source 10:10:10::2 template test</pre>
R2	Register R1 as a BFD neighbor.	<pre>vyatta@R2#set protocols static route6 1:1:1::1/128 next-hop 10:10:10::1 fall-over bfd</pre>
R2	Commit the configuration.	<pre>vyatta@R2#commit</pre>
R2	Save the configuration.	<pre>vyatta@R2#save</pre>
R2	Display the configuration.	<pre>vyatta@R2#show protocols static route6 static { route6 1:1:1::1/128 { next-hop 10:10:10::1 {</pre>

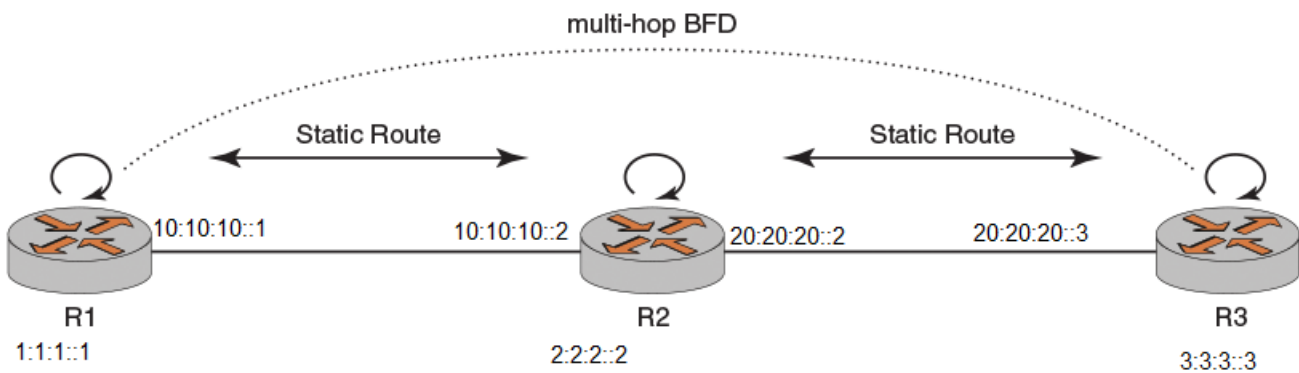
TABLE 13 Configuring BFD for Static Route Single Hop by Using IPv6 Addressing (continued)

Router	Step	Command
		<pre> fall-over { bfd } } } vyatta@R2#show protocols bfd bfd { destination 10:10:10::1 { source 10:10:10::2 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

Configuring BFD for static route multiple hop by using IPv6 addressing

To configure BFD multiple hop by using IPv6 addressing, you must first set up the routing protocol such as static route or BGP between the two peer systems.

FIGURE 16 Configuring BFD for static route multiple hop by using IPv6 addressing



Consider a scenario in which you have three systems, R1, R2, and R3. R1 and R2 share a static route, R2 and R3 also share a static route. The following list provides the addresses of R1, R2, and R3.

- R1 loopback address—1:1:1:1/128

- R1 interface address facing R2—10:10:10::1/64
- R2 loopback address— 2:2:2::1/128
- R2 interface address facing R1—10:10:10::2/64
- R2 interface address facing R3—20:20:20::2/64
- R3 interface address facing R2—20:20:20::3/64
- R3 loopback address—3:3:3::3/128

To configure a BFD session between R1 and R3, perform the following steps in configuration mode.

TABLE 14 Configuring BFD for Static Route Multiple Hop by Using IPv6 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R3 and the source address of R1.	<code>vyatta@R1#set protocols bfd destination 20:20:20::3 source 10:10:10::1 template test</code>
R1	Register R3 as a BFD neighbor.	<code>vyatta@R1#set protocols static route6 3:3:3::3/128 next-hop 20:20:20::3 fall-over bfd</code>
R1	Commit the configuration.	<code>vyatta@R1#commit</code>
R1	Save the configuration.	<code>vyatta@R1#save</code>
R1	Display the configuration.	<pre>vyatta@R1#show protocols static route6 static { route6 3:3:3::3/128 { next-hop 20:20:20::3 { fall-over { bfd } } } } vyatta@R1# show protocols bfd bfd { destination 20:20:20::3 { source 10:10:10::1 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>
R3	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R3	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R3.	<code>vyatta@R3#set protocols bfd destination 10:10:10::1 source 20:20:20::3 template test</code>

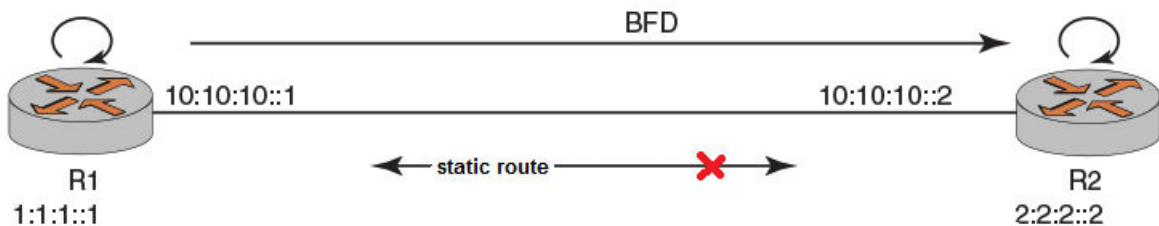
TABLE 14 Configuring BFD for Static Route Multiple Hop by Using IPv6 Addressing (continued)

Router	Step	Command
R3	Register R1 as a BFD neighbor.	<pre>vyatta@R3#set protocols static route6 1:1:1::1/128 next-hop 10:10:10::1 fall-ver bfd</pre>
R3	Commit the configuration.	<pre>vyatta@R3#commit</pre>
R3	Save the configuration.	<pre>vyatta@R3#save</pre>
R3	Display the configuration.	<pre>vyatta@R3#show protocols static route6 static { route6 1:1:1::1/128 { next-hop 10:10:10::1 { fall-over { bfd } } } } vyatta@R3# show protocols bfd bfd { destination 10:10:10::1 { source 20:20:20::3 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } }</pre>

Configuring a BFD helper session by using IPv6 addressing

You can configure a static route from a router R1 to another router R2, without configuring another static route from R2 to R1. In such a case, you can enable BFD only from R1 to R2 with static route as the client. BFD must be configured at both routers for it to be operational, you can use a helper session to compensate the lack of a static route from R2 to R1.

FIGURE 17 Configuring a BFD helper session by using IPv6 addressing



Consider two routers R1 and R2. There is a static route from R2 to R1, and but no static route from R1 to R2.. You can enable BFD for R1.

NOTE

The `source any` parameter is not supported for the helper session command.

The helper session is supported for both IPv4 and IPv6 addresses. The following list provides the addresses of R1 and R2.

- R1 interface address facing R2—10:10:10::1
- R2 interface address facing R1—10:10:10::2

To configure BFD using a helper session, perform the following steps in configuration mode.

TABLE 15 Configuring a BFD Helper Session by Using IPV6 Addressing

Router	Step	Command
R1	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD <code>test</code> template with the destination address of R2 and the source address of R1.	<pre>vyatta@R1#set protocols bfd destination 10:10:10::2 source 10:10:10::1 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set protocols bfd destination 10:10:10::2 source 10:10:10::1 helper-session</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols bfd protocols { bfd { destination 10:10:10::2 { source 10:10:10::1 { template test helper-session } } } }</pre>

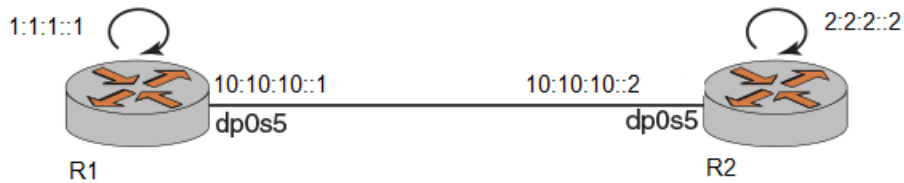
Configuring BFD for OSPFv3

BFD for OSPFv3 is supported for physical interfaces, virtual interfaces, and virtual links. OSPFv3 uses IPv6 addressing.

Configuring BFD for OSPFv3 on a physical interface by using IPv6 addressing

To configure BFD for all OSPFv3 neighbors on a physical interface, you must first configure OSPFv3 for all the neighbors.

FIGURE 18 Configuring BFD for OSPFv3 on a physical interface by using IPv6 addressing



Consider a scenario in which you have two systems, R1 and R2. R1 and R2 are OSPFv3 neighbors, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 loopback address—1:1:1::1/128
- R1 interface address—10:10:10::1/64
- R2 loopback address—2:2:2::2/128
- R2 interface address—10:10:10::2/64
- Data plane interface name—dp0s5
- R1 link local address—fe80::6061:ff:fe00:b7d5
- R2 link local address—fe80::5054:ff:fe00:b6d5

NOTE

For OSPFv3 configurations, you must use the link local addresses for R1 and R2 for source and destination.

To configure a BFD session between R1 and R2, perform the following steps in configuration mode. BFD for OSPFv3 is configured on the physical interface.

TABLE 16 Configuring BFD for OSPFv3 on a Physical Interface by Using IPv6 Addressing

Router	Step	Command
R1	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD test template with the destination address of R2 and the source address of R1.	<pre>vyatta@R1#set protocols bfd destination fe80::5054:ff:fe00:b6d5 source fe80::6061:ff:fe00:b7d5 template test</pre>

TABLE 16 Configuring BFD for OSPFv3 on a Physical Interface by Using IPv6 Addressing (continued)

Router	Step	Command
	<p>NOTE</p> <p>You can also associate the BFD parameter template with the interface by using the set interface dataplane <if_name> bfd template <template_name> command.</p>	
R1	Start a BFD instance on the interface.	<code>vyatta@R1# set interface dataplane dp0s5 ip ospfv3 fall-over bfd</code>
R1	Commit the configuration.	<code>vyatta@R1#commit</code>
R1	Save the configuration.	<code>vyatta@R1#save</code>
R1	Display the configuration.	<pre>vyatta@R1#show interfaces interfaces { dataplane dp0s5 { address dhcp6 } dataplane dp0s5 { address 10:10:10::1 ip { ospfv3 { fall-over { bfd } } } } } vyatta@R1#show protocols bfd bfd { destination fe80::5054:ff:fe00:b6d5 { source fe80::6061:ff:fe00:b7d5 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>
R2	Create a BFD template called <code>test</code> .	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD <code>test</code> template with the destination address of R1 and the source address of R2.	<code>vyatta@R2#set protocols bfd destination fe80::6061:ff:fe00:b7d5 source fe80::5054:ff:fe00:b6d5 template test</code>

TABLE 16 Configuring BFD for OSPFv3 on a Physical Interface by Using IPv6 Addressing (continued)

Router	Step	Command
	<p>NOTE</p> <p>You can also associate the BFD parameter template with the interface by using the set interface dataplane <if_name> bfd template <template_name> command.</p>	
R2	Commit the configuration.	vyatta@R2#commit
R2	Save the configuration.	vyatta@R2#save
R2	Display the configuration.	<pre> vyatta@R2#show interfaces interfaces { dataplane dp0s5 { address dhcp6 } dataplane dp0s5 { address 10:10:10::2 ip { ospfv3 { fall-over { bfd } } } } } vyatta@R2#show protocols bfd bfd { destination fe80::6061:ff:fe00:b7d5 { source fe80::5054:ff:fe00:b6d5 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

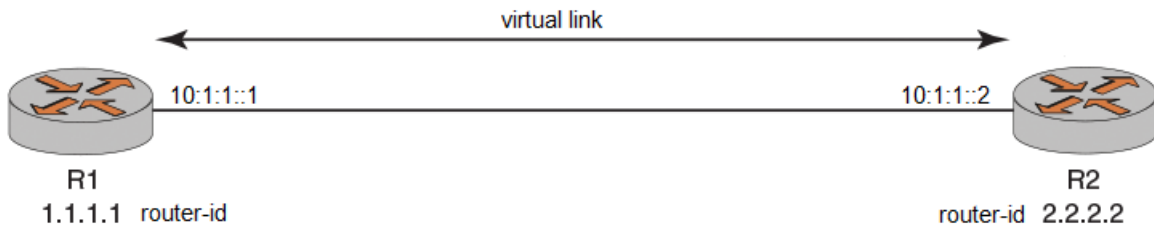
Configuring BFD for OSPFv3 on a virtual link by using IPv6 addressing

To configure BFD for OSPFv3 neighbors on a virtual link, you must first configure the virtual link between the disconnected backbone area routers and then enable BFD on the virtual link.

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share an OSPFv3 session, sharing a virtual link, as illustrated in the reference network diagram. The following list provides the addresses of R1 and R2.

- R1 router-id—1.1.1.1
- R2 router-id—2.2.2.2
- R1 interface address facing R2—10:1:1::1
- R2 interface address facing R1—10:1:1::2
- R1 link local address—fe80::6061:ff:fe00:b7d5
- R2 link local address—fe80::5054:ff:fe00:b6d5

FIGURE 19 Configuring BFD for OSPFv3 on a virtual link by using IPv6 addressing



NOTE

For OSPFv3 configurations, you must use the link local addresses for R1 and R2 for source and destination.

Virtual link is configured in a transit area. A virtual link chooses any address to reach other virtual link end points in the same transit area. Therefore, the source and destination addresses in a 3-router configuration or a more complex configuration are selected dynamically. You must ensure that you select the correct source and destination addresses for your BFD commands for OSPFv2 and OSPFv3 virtual links. To configure a BFD session between R1 and R2, perform the following steps in configuration mode.

TABLE 17 Configuring BFD for OSPFv3 on a Virtual Link by Using IPv6 Addressing

Router	Step	Command
R1	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R1	Associate the BFD test template with the destination address of R2 and the source address of R1.	<pre>vyatta@R1#set protocols bfd destination fe80::5054:ff:fe00:b6d5 source fe80::6061:ff:fe00:b7d5 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set protocols ospfv3 area 1 virtual-link 2.2.2.2 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show protocols ospf ospfv3 { area 1 { network 10:1:1::0/128 virtual-link 2.2.2.2 { fall-over { bfd } } } }</pre>

TABLE 17 Configuring BFD for OSPFv3 on a Virtual Link by Using IPv6 Addressing (continued)

Router	Step	Command
		<pre> parameters { } } vyatta@R1#show protocols bfd bfd { destination fe80::5054:ff:fe00:b6d5 { source fe80::6061:ff:fe00:b7d5 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>
R2	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD test template with the destination address of R1 and the source address of R2.	<pre> vyatta@R2#set protocols bfd destination fe80::6061:ff:fe00:b7d5 source fe80::5054:ff:fe00:b6d5 template test </pre>
R2	Register R1 as a BFD neighbor.	<pre> vyatta@R2#set protocols ospfv3 area 1 virtual-link 1.1.1.1 fall-over bfd </pre>
R2	Commit the configuration.	<pre> vyatta@R2#commit </pre>
R2	Save the configuration.	<pre> vyatta@R2#save </pre>
R2	Display the configuration.	<pre> vyatta@R2#show protocols ospf ospfv3 { area 1 { network 10:1:1::0/128 virtual-link 1.1.1.1 { fall-over { bfd } } } parameters { } } vyatta@R2#show protocols bfd bfd { destination fe80::6061:ff:fe00:b7d5 { source fe80::5054:ff:fe00:b6d5 { template test } } template test { auth { </pre>

TABLE 17 Configuring BFD for OSPFv3 on a Virtual Link by Using IPv6 Addressing (continued)

Router	Step	Command
		<pre> simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } } </pre>

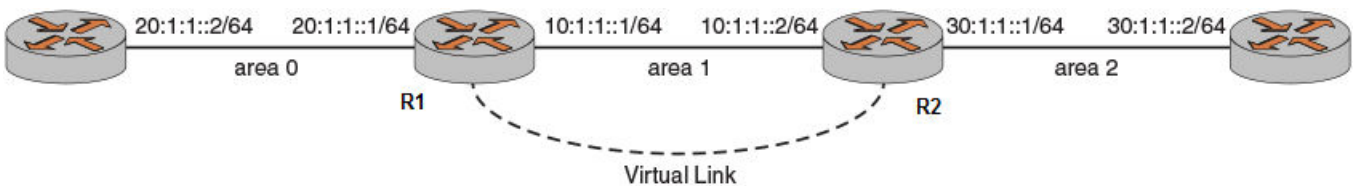
Configuring BFD for OSPFv3 on a virtual interface by using IPv6 addressing

To configure BFD for OSPFv3 neighbors on a virtual interface, you must first configure the OSPFv3 and the virtual interface for the two neighbors.

Consider a scenario in which you have two systems, R1 and R2. R1 and R2 share an OSPFv3 session. R1 and R2 are on a physical interface named dp0s5 which also has a virtual interface configured for the VLAN identifier of vlan-51. The following list provides the addresses of R1 and R2.

- R1 loopback address—1:1:1::1/128
- Data plane interface name—dp0s5
- VLAN identifier—vlan-51
- R1 interface facing vif 51—10:1:1::1/64
- R2 interface facing vif 51—10:1:1::2/64
- R2 loopback address—2:2:2::2/128
- R1 link local address—fe80::6061:ff:fe00:b7d5
- R2 link local address—fe80::5054:ff:fe00:b6d5

FIGURE 20 Configuring BFD for OSPFv3 on a virtual interface by using IPv6 addressing



NOTE

For OSPFv3 configurations, you must use the link local addresses for R1 and R2 for source and destination.

To configure a BFD session between R1 and R2, perform the following steps in configuration mode.

TABLE 18 Configuring BFD for OSPFv3 on a Virtual Interface by Using IPv6 Addressing

Router	Step	Command
R1	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.

TABLE 18 Configuring BFD for OSPFv3 on a Virtual Interface by Using IPv6 Addressing (continued)

Router	Step	Command
R1	Associate the BFD test template with the destination address of R2 and the source address of R1. NOTE You can also associate the BFD parameter template with the interface by using the set interface dataplane vif <vf_id> bfd template <template-name> command.	<pre>vyatta@R1#set protocols bfd destination fe80::5054:ff:fe00:b6d5 source fe80::6061:ff:fe00:b7d5 template test</pre>
R1	Register R2 as a BFD neighbor.	<pre>vyatta@R1#set interfaces dataplane dp0s4 vif 51 ip ospfv3 fall-over bfd</pre>
R1	Commit the configuration.	<pre>vyatta@R1#commit</pre>
R1	Save the configuration.	<pre>vyatta@R1#save</pre>
R1	Display the configuration.	<pre>vyatta@R1#show interfaces interfaces { dataplane dp0s5 { ip { ospfv3 { fall-over { bfd } } } vif 51 { address 10:1:1::1/64 ip { ospfv3 { fall-over { bfd } } } vlan 51 } } loopback lo { address 1:1:1::1/128 } } vyatta@R1#show protocols protocols { bfd { destination fe80::5054:ff:fe00:b6d5 { source fe80::6061:ff:fe00:b7d5 { template test } } } template test{</pre>

TABLE 18 Configuring BFD for OSPFv3 on a Virtual Interface by Using IPv6 Addressing (continued)

Router	Step	Command
		<pre> auth { simple { key "*****" } } } minimum-rx 300 minimum-tx 300 multiplier 3 } ospfv3 { area 1 { network 10:1:1::0/64 } redistribute { connected } } } } } } } } </pre>
R2	Create a BFD template called test.	See section Configuring a BFD parameter template on page 17.
R2	Associate the BFD test template with the destination address of R1 and the source address of R2. NOTE You can also associate the BFD parameter template with the interface by using the set interface dataplane vif <vf_id> bfd template <template-name> command.	<pre> vyatta@R2#set protocols bfd destination fe80::6061:ff:fe00:b7d5 source fe80::5054:ff:fe00:b6d5 template test </pre>
R2	Register R1 as a BFD neighbor.	<pre> vyatta@R2#set interfaces dataplane dp0s4 vif 51 ip ospfv3 fall-over bfd </pre>
R2	Commit the configuration.	<pre> vyatta@R2#commit </pre>
R2	Save the configuration.	<pre> vyatta@R2#save </pre>
R2	Display the configuration.	<pre> vyatta@R2#show interfaces interfaces { dataplane dp0s5 { ip { ospfv3 { fall-over { bfd } } } } vif 51 { address 10:1:1::2/64 ip { ospfv3 { </pre>

TABLE 18 Configuring BFD for OSPFv3 on a Virtual Interface by Using IPv6 Addressing (continued)

Router	Step	Command
		<pre> fall-over { bfd } } } } } } } } } } } } vyatta@R2#show protocols protocols { bfd { destination fe80::6061:ff:fe00:b7d5 { source fe80::5054:ff:fe00:b6d5 { template test } } template test { auth { simple { key "*****" } } minimum-rx 300 minimum-tx 300 multiplier 3 } ospfv3 { area 1 { network 10:1:1::0/64 } redistribute { connected } } } } </pre>

BFD Commands

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- interface dataplane <if_name> ip ospf fall-over bfd..... 63
- interface dataplane <if_name> ip ospfv3 fall-over bfd..... 64
- interface dataplane <if_name> vif <vif-id> bfd template <template-name>..... 65
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- protocols bfd destination <destination_ip_address> source <source_ip_address> helper-session.....71
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- protocols ospfv3 area <area-id> virtual-link <dest_router_id> fall-over bfd.....81
- protocols static route <destination_ipv4_address> next-hop <nexthop_ipv4_address> fall-over bfd 82
- protocols static route6 <destination_ipv6_address> next-hop <nexthop_ipv6_address> fall-over bfd 84
- show bfd session interface <if_name>..... 86

interface dataplane <if_name> bfd template <template_name>

Associates a BFD parameter template with a single-hop BFD session, which originates from the specified interface.

Syntax

set interface dataplane *if_name* **bfd template** *template_name*

delete interface dataplane *if_name* **bfd template** *template_name*

show interface dataplane *if_name*

Command Default

If a BFD parameter template is not specified, minimum-tx is taken as 300, minimum-rx is taken as 300, and the multiplier is taken as 3.

Parameters

dataplane *if_name*

Specifies name of a data plane interface in the format of dpOxy.

template *template_name*

Specifies name of a BFD parameter template.

Modes

Configuration mode

Configuration Statement

```
interface {  
    dataplane if_name {  
        bfd {  
            template template_name  
        }  
    }  
}
```

Usage Guidelines

Use this command to associate a BFD parameter template with a single-hop BFD session, which is specified by the interface name.

Use the **set** form of the command to associate a BFD parameter template with a single-hop BFD session.

Use the **delete** form of the command to remove a BFD parameter template that is associated with a single-hop BFD session.

Use the **show** form of the command to display the BFD parameter template configured for the interface.

Examples

The following example shows how to associate a BFD parameter template called `test` with a data plane interface called `dp0s7` for a single-hop BFD session.

```
vyatta@vyatta#set interface dataplane dp0s7 bfd template test
```

interface dataplane <if_name> ip ospf fall-over bfd

Initiates a BFD session for all OSPFv2 neighbors on a physical interface.

Syntax

```
set interface dataplane if_name ip ospf fall-over bfd
delete interface dataplane if_name ip ospf fall-over bfd
show interface dataplane if_name
```

Command Default

BFD for OSPFv2 is disabled by default.

Parameters

dataplane *if_name*
Specifies name of a data plane interface in the format of dpOxy.

Modes

Configuration mode

Configuration Statement

```
interface dataplane if_name {
    ip {
        ospf {
            fall-over {
                bfd
            }
        }
    }
}
```

Usage Guidelines

Use this command to initiate a BFD session for all OSPFv2 neighbors on a physical interface.

Use the **set** version of the command to initiate a BFD session for all OSPFv2 neighbors on a physical interface.

Use the **delete** version of the command to delete a BFD session for all OSPFv2 neighbors on a physical interface.

Use the **show** form of the command to display the BFD parameter template configured for the interface.

Examples

The following example shows how to initiate a BFD session for all OSPFv2 neighbors on a physical interface called dp0s4.

```
vyatta@vyatta#set interface dataplane dp0s4 ip ospf fall-over bfd
```

interface dataplane <if_name> ip ospfv3 fall-over bfd

Initiates a BFD session for all OSPFv3 neighbors on a physical interface.

Syntax

```
set interface dataplane if_name ip ospfv3 fall-over bfd
delete interface dataplane if_name ip ospfv3 fall-over bfd
show interface dataplane if_name
```

Command Default

BFD for OSPFv3 is disabled by default.

Parameters

dataplane *if_name*
Specifies name of a data plane interface in the format of dpOxy.

Modes

Configuration mode

Configuration Statement

```
interface dataplane if_name {
    ip {
        ospfv3 {
            fall-over {
                bfd
            }
        }
    }
}
```

Usage Guidelines

Use this command to initiate a BFD session for all OSPFv3 neighbors on a physical interface.

Use the **set** version of the command to initiate a BFD session for all OSPFv3 neighbors on a physical interface.

Use the **delete** version of the command to delete a BFD session for all OSPFv3 neighbors on a physical interface.

Use the **show** form of the command to display the BFD parameter template configured for the interface.

Examples

The following example shows how to initiate a BFD session for all OSPFv3 neighbors on a physical interface called dp0s4.

```
vyatta@vyatta#set interface dataplane dp0s4 ip ospf fall-over bfd
```


interface dataplane <if_name> vif <vif_id> bfd template <template-name>

Associates a BFD parameter template with a BFD session, which is specified by the virtual interface name.

Syntax

set interface dataplane *if_name* **vif** *vif_id* **bfd template** *template-name*

delete interface dataplane *if_name* **vif bfd template** *template-name*

show interface dataplane *if_name*

Command Default

If a BFD parameter template is not specified, minimum-tx is taken as 300, minimum-rx is taken as 300, and the multiplier is taken as 3.

Parameters

dataplane *if_name*

Specifies name of a data plane interface in the format of dpOxy.

vif *vif_id*

Specifies a VLAN identifier for a virtual interface. The identifier ranges from 0 through 4094.

template *template_name*

Specifies name of a BFD parameter template.

Modes

Configuration mode

Configuration Statement

```
interface {
  dataplane if_name {
    vif vif_id {
      bfd {
        template template_name
      }
    }
  }
}
```

Usage Guidelines

Use this command to associate a BFD parameter template with a single-hop BFD session that is specified by the virtual interface name.

Use the **set** form of the command to associate a BFD parameter template with a BFD session.

Use the **delete** form of the command to remove a BFD parameter template that is associated with a BFD session.

Use the **show** form of the command to display the BFD parameter template configured for the interface.

Examples

The following example shows how to associate a BFD parameter template called `test` with a virtual interface `vif 10` for a BFD session.

```
vyatta@vyatta# set interface dataplane dp0s4 vif 10 bfd template test
```

interfaces dataplane <if_name> vif <vif-id> ip ospf fall-over bfd

Initiates a BFD session for all OSPFv2 neighbors on a virtual interface.

Syntax

set interfaces dataplane *if_name* vif *vif-id* ip ospf fall-over bfd

delete interfaces dataplane *if_name* vif *vif-id* ip ospf fall-over bfd

show interface dataplane *if_name*

Command Default

BFD for OSPFv2 is disabled by default.

Parameters

dataplane *if_name*

Specifies name of a data plane interface.

vif *vif-id*

Specifies a VLAN identifier for a virtual interface. The identifier ranges from 0 through 4094.

Modes

Configuration mode

Configuration Statement

```
interface dataplane if_name {
    vif vif-id {
        ip {
            ospf {
                fall-over {
                    bfd
                }
            }
        }
    }
}
```

Usage Guidelines

Use this command to initiate a BFD session for all OSPFv2 neighbors on a virtual interface.

Use the **set** version of the command to initiate a BFD session for all OSPFv2 neighbors on a virtual interface.

Use the **delete** version of the command to delete a BFD session for all OSPFv2 neighbors on a virtual interface.

Use the **show** form of the command to display the BFD parameter template configured for the interface.

Examples

The following example shows how to initiate a BFD session for all OSPFv2 neighbors on a virtual interface with a VLAN identifier of 51.

```
vyatta@vyatta#set interfaces dataplane dp0s4 vif 51 ip ospf fall-over bfd
```

interfaces dataplane <if_name> vif <vif-id> ip ospfv3 fall-over bfd

Initiates a BFD session for all OSPFv3 neighbors on a virtual interface.

Syntax

```
set interfaces dataplane if_name vif vif-id ip ospfv3 fall-over bfd
delete interfaces dataplane if_name vif vif-id ip ospfv3 fall-over bfd
show interface dataplane if_name
```

Command Default

BFD for OSPFv3 is disabled by default.

Parameters

dataplane *if_name*

Specifies name of a data plane interface in the format of dp0.xy.

vif *vif-id*

Specifies a VLAN identifier for a virtual interface. The identifier ranges from 0 through 4094.

Modes

Configuration mode

Configuration Statement

```
interface dataplane if_name{
    vif vif-id {
        ip {
            ospfv3 {
                fall-over {
                    bfd
                }
            }
        }
    }
}
```

Usage Guidelines

Use this command to initiate a BFD session for all OSPFv3 neighbors on a virtual interface.

Use the **set** version of the command to initiate a BFD session for all OSPFv3 neighbors on a virtual interface.

Use the **delete** version of the command to delete a BFD session for all OSPFv3 neighbors on a virtual interface.

Use the **show** form of the command to display the BFD parameter template configured for the interface.

Examples

The following example shows how to initiate a BFD session for all OSPFv3 neighbors on a virtual interface with a VLAN identifier of 51.

```
vyatta@vyatta#set interfaces dataplane dp0s4 vif 51 ip ospf fall-over bfd
```

protocols bfd destination <destination_ip_address> source <source_ip_address> helper-session

Initiates a BFD session with a neighboring system with which the source system shares a routing protocol such as static route, however the neighboring system does not share a static route with the source system.

Syntax

```
set protocols bfd destination destination_ip_address source source_ip_address helper-session
delete protocols bfd destination destination_ip_address source source_ip_address helper-session
show protocols bfd
```

Command Default

The BFD helper session is disabled by default.

Parameters

destination_ip_address
IPv4 or IPv6 address of the destination system.

source_ip_address
IPv4 or IPv6 address of the source system.

Modes

Configuration mode

Configuration Statement

```
protocols {
    bfd {
        destination destination_ip_address {
            source source_ip_address {
                helper-session
            }
        }
    }
}
```

Usage Guidelines

Use this command to monitor a BFD session initiated by the peer, where only the peer has a static client.

Use the **set** form of the command to initiate a BFD session with a neighboring system.

Use the **delete** form of the command to delete a BFD session with a neighboring system.

Use the **show** form of the command to display the details of a BFD session.

NOTE

The `source any` parameter is not supported for the helper session command.

Examples

The following example shows how to set a BFD session with a neighboring system with which the source system shares a routing protocol such as static route, however the neighboring system does not share a static route with the source system. The interface address of the source is 10.37.99.161 and the interface address of the destination system is 10.37.99.162.

```
vyatta@vyatta#set protocols bfd destination 10.37.99.162 source 10.37.99.161 helper-session
```


protocols bfd destination <destination_ip_address> source <source_ip_address> template <template_name>

Associates a BFD parameter template with a BFD session, which is specified by the source and destination address template.

Syntax

set protocols bfd destination *destination_ip_address* source { *source_ip_address* | any } **template** *template_name*

delete protocols bfd destination *destination_ip_address* source { *source_ip_address* | any } **template** *template_name*

show protocols bfd

Command Default

If the BFD parameter template is not specified, minimum-tx is taken as 300, minimum-rx is taken as 300, and the multiplier is taken as 3.

Parameters

destination_ip_address

IPv4 or IPv6 address of a destination system.

source_ip_address

IPv4 or IPv6 address of a source system.

any

Associates a BFD template with all BFD sessions to the destination system.

template *template_name*

Specifies name of a BFD parameter template.

Modes

Configuration Mode

Configuration Statement

```
protocols {
  bfd {
    destination destination_ip_address {
      source source_ip_address | any }
    {
      template template_name
    }
  }
}
```

Usage Guidelines

Use this command to associate a BFD parameter template with a BFD session, which is specified by the source and destination IP addresses.

Use the **set** form of the command to associate a BFD parameter template with a BFD session.

Use the **delete** form of the command to remove a BFD parameter template associated with a BFD session.

Use the **show** form of the command to display the details of a BFD session.

Examples

The following example shows how to associate a BFD parameter template called `test` with a BFD source and destination address template.

```
vyatta@vyatta#set protocols bfd destination 10.37.99.162 source 10.37.99.161 template test
```

The following example shows how to associate a BFD parameter template called `test` with a BFD session by using the `any` parameter. The `any` parameter associates the BFD parameter template with all BFD sessions with destination `10.37.99.162`.

```
vyatta@vyatta#set protocols bfd destination 10.37.99.162 source any template test
```

protocols bfd template <template_name>

Creates a BFD template that specifies the minimum-rx value, minimum-tx value, multiplier value, and authentication type for the BFD session.

Syntax

```
set protocols bfd template template_name [minimum-rx minimum-rx_value | minimum-tx minimum-tx_value | multiplier
multiplier_value | auth simple key key_string]
delete protocols bfd template template_name
show protocols bfd
```

Command Default

If a BFD parameter template is not specified, minimum-tx is taken as 300, minimum-rx is taken as 300, and the multiplier is taken as 3.

Parameters

template *template_name*
Specifies name of a BFD parameter template.

minimum-rx *minimum-rx_value*
Specifies a minimum receiving interval for the BFD session. The interval ranges 20 through 10000 ms.

minimum-tx *minimum-tx_value*
Specifies a minimum transmission interval for the BFD session. The interval ranges 20 through 10000 ms.

multiplier *multiplier_value*
Specifies a multiplier for the BFD session. The multiplier ranges 1 through 100.

key *key_string*
Specifies an alphanumeric password.

Modes

Configuration mode

Configuration Statement

```
bfd
{
  template template_name {
    auth {
      simple {
        key key_string
      }
    }
    minimum-rx minimum-rx_value
    minimum-tx minimum-tx_value
    multiplier multiplier_value
  }
}
```

Usage Guidelines

Use the command to create a BFD parameter template that specifies the minimum-rx value, minimum-tx value, multiplier value, and authentication type for the BFD session.

Use the **set** form of the command to set a BFD template that specifies the minimum-rx value, minimum-tx value, multiplier value, and authentication type for the BFD session.

Use the **delete** form of the command to delete a BFD template.

Use the **show** form of the command to display the details of a BFD session.

Examples

The following example shows how to set the values for a BFD template called `test`.

```
vyatta@vyatta#set protocols bfd template test multiplier 3
vyatta@vyatta#set protocols bfd template test minimum-rx 300
vyatta@vyatta#set protocols bfd template test minimum-tx 300
vyatta@vyatta#set protocols bfd template test auth simple key lotr
```

protocols bgp <asn> neighbor <ip_address> fall-over bfd

Initiates a BFD session with a neighboring peer with which the system already shares a BGP session.

Syntax

```
set protocols bgp asn neighbor ip_address fall-over bfd
```

```
delete protocols bgp asn neighbor ip_address fall-over bfd
```

```
show protocols bfd
```

Command Default

BFD for BGP is disabled by default.

Parameters

asn

Number of the AS in which a system resides.

neighbor *ip_address*

Specifies an IPv4 or IPv6 address of a peer system with which BFD is set up.

Modes

Configuration mode

Configuration Statement

```
bgp {
  asn neighbor {
    fall-over {
      bfd
    }
  }
}
```

Usage Guidelines

Use this command to initiate a BFD session with a neighboring peer with which the system already shares a BGP session.

Use the **set** form of the command to initiate a BFD session with a neighboring peer with which the system already shares a BGP session.

Use the **delete** form of the command to delete a BFD session with a neighboring peer with which the system already shares a BGP session.

Use the **show** form of the command to display the details of a BFD session.

Examples

The following example shows how to initiate a BFD session with a neighboring peer whose interface address facing the system is 10.37.99.162. The two systems share a BGP session.

```
vyatta@vyatta# set protocols bgp 100 neighbor 10.37.99.162 fall-over bfd
```

protocols ospf area <area-id> virtual-link <dest_router_id> fall-over bfd

Initiates a BFD session for two OSPFv2 neighbors on a virtual link.

Syntax

set protocols ospf area *area-id* virtual-link *dest_router_id* fall-over bfd

delete protocols ospf area *area-id* virtual-link *dest_router_id* fall-over bfd

show protocols bfd

Command Default

BFD for OSPFv2 is disabled by default.

Parameters

area *area-id*

Specifies the identifier of an OSPFv2 area configured. The identifier is an IP address or a decimal value.

dest_router_id

Destination router identifier of an OSPFv2 process. The identifier is an IPv4 address.

Modes

Configuration mode

Configuration Statement

```
protocols {
    ospf {
        area area-id {
            virtual-link dest_router_id {
                fall-over bfd
            }
        }
    }
}
```

Usage Guidelines

Use this command to initiate a BFD session for two OSPFv2 neighbors on a virtual link.

Use the **set** form of the command to initiate a BFD session for two OSPFv2 neighbors on a virtual link.

Use the **delete** form of the command to delete the BFD session for two OSPFv2 neighbors on a virtual link.

Use the **show** form of the command to display the details of a BFD session.

Examples

The following example shows how to initiate a BFD session for two OSPFv2 neighbors on a virtual link. The destination router identifier is 2.2.2.2.

```
vyatta@vyatta# set protocols ospf area 1 virtual-link 2.2.2.2 fall-over bfd
```


protocols ospfv3 area <area-id> virtual-link <dest_router_id> fall-over bfd

Initiates a BFD session for two OSPFv3 neighbors on a virtual link.

Syntax

set protocols ospfv3 area *area-id* virtual-link *dest_router_id* fall-over bfd

delete protocols ospfv3 area *area-id* virtual-link *dest_router_id* fall-over bfd

show protocols bfd

Command Default

BFD for OSPFv3 is disabled by default.

Parameters

area *area-id*

Specifies the identifier of an OSPFv3 area configured. The identifier is an IP address or a decimal value.

dest_router_id

Destination router identifier of an OSPFv3 process. The identifier is an IPv4 address.

Modes

Configuration mode

Configuration Statement

```
protocols {
    ospfv3 {
        area area-id {
            virtual-link dest_router_id {
                fall-over bfd
            }
        }
    }
}
```

Usage Guidelines

Use this command to initiate a BFD session for two OSPFv3 neighbors on a virtual link.

Use the **set** form of the command to initiate a BFD session for two OSPFv3 neighbors on a virtual link.

Use the **delete** form of the command to delete the BFD session for two OSPFv3 neighbors on a virtual link.

Use the **show** form of the command to display the details of a BFD session.

Examples

The following example shows how to initiate a BFD session for two OSPFv3 neighbors on a virtual link. The destination router identification is 2.2.2.2.

```
vyatta@vyatta#set protocols ospfv3 area 1 virtual-link 2.2.2.2 fall-over bfd
```

protocols static route <destination_ipv4_address> next-hop <nexthop_ipv4_address> fall-over bfd

Initiates a BFD session between two BFD peers on a static route by using IPv4 addressing.

Syntax

set protocols static route *destination_ipv4_address* **next-hop** *nexthop_ipv4_address* **fall-over bfd**

delete protocols static route *destination_ipv4_address* **next-hop** *nexthop_ipv4_address* **fall-over bfd**

show protocols bfd

Command Default

BFD for static routes is disabled by default.

Parameters

destination_ipv4_address

IPv4 address of the destination system.

nexthop_ipv4_address

IPv4 address of the next-hop system enroute to the destination system.

Modes

Configuration mode

Configuration Statement

```
protocols {
  static {
    route destination_ipv4_address {
      next-hop nexthop_ipv4_address {
        fall-over {
          bfd
        }
      }
    }
  }
}
```

Usage Guidelines

Use this command to set up a BFD session between two systems on a static route by using IPv4 addressing.

Use the **set** form of this command to initiate a BFD session between two systems on a static route by using IPv4 addressing.

Use the **delete** form of this command to remove a BFD session between two systems on a static route by using IPv4 addressing.

Use the **show** form of this command to view the details of a BFD session.

Examples

The following example shows how to initiate a BFD session on a system that is connected to another system on a static route by using IPv4 addressing. The loopback address of the destination system is 2.2.2.2/32 and the interface address of the destination system is 10.10.10.2.

```
vyatta@vyatta#set protocols static route 2.2.2.2/32 next-hop 10.10.10.2 fall-over bfd
```

protocols static route6 <destination_ipv6_address> next-hop <nexthop_ipv6_address> fall-over bfd

Initiates a BFD session between two systems on a static route by using IPv6 addressing.

Syntax

```
set protocols static route6 destination_ipv6_address next-hop nexthop_ipv6_address fall-over bfd
delete protocols static route6 destination_ipv6_address next-hop nexthop_ipv6_address fall-over bfd
show protocols bfd
```

Command Default

BFD for static routes is disabled by default.

Parameters

destination_ipv6_address

IPv6 address of the destination system.

nexthop_ipv6_address

IPv6 address of the next-hop system enroute to the destination system.

Modes

Configuration mode

Configuration Statement

```
protocols {
  static {
    route6 destination_ipv6_address {
      next-hop nexthop_ipv6_address {
        fall-over {
          bfd
        }
      }
    }
  }
}
```

Usage Guidelines

Use this command to set up a BFD session between two systems on a static route by using IPv6 addressing.

Use the **set** form of this command to initiate a BFD session between two systems on a static route by using IPv6 addressing.

Use the **delete** form of this command to remove a BFD session between two systems on a static route by using IPv6 addressing.

Use the **show** form of this command to view the details of a BFD session.

Examples

The following example shows how to initiate a BFD session on a system that is connected to another system on a static route by using IPv6 addressing. The loopback address of the destination system is 2:2:2::2/128 and the interface address of the destination system is 10:10:10::20.

```
vyatta@vyatta#set protocols static route6 2:2:2::2/128 next-hop 10:10:10::20 fall-over bfd
```

show bfd session interface <if_name>

Displays BFD session information for a system interface.

Syntax

```
show bfd session [ interface if_name [ detail [ destination_ipv4_address | destination_ipv6_address ] ] ]
```

Parameters

interface *if_name*

Specifies a data plane interface name.

detail

Specifies a detailed report for the BFD session.

destination_ipv4_address

IPv4 address of the destination of the BFD session.

destination_ipv6_address

IPv6 address of the destination of the BFD session.

Modes

Operational mode.

Usage Guidelines

Use the command to display the BFD session on a system interface.

Command Output

The **show bfd session interface** command for the `dp0s6` interface displays the following information:

```
vyatta@vyatta:~$ show bfd session interface ifname dp0s6
Interface:      dp0s6  state: Up
Sess-Idx  Remote-Disc  Lower-Layer  Sess-Type  Sess-State  UP-Time  Remote-Addr
IPv4 Sessions:
1          0              IPv4         Single-Hop  Down        00:00:00  20.20.20.20/32
```

```
vyatta@vyatta:~$ show bfd session interface ifname dp0s6 detail
=====
Session Interface Name : dp0s6           Session Index : 1
Lower Layer : IPv4                     Version : 1
Session Type : Single Hop              Session State : Down
Local Discriminator : 1                 Local Address : 20.20.20.10/32
Remote Discriminator : 0                Remote Address : 20.20.20.20/32
Local Port : 49152                      Remote Port : 3784

Diagnostics : None

Configured parameters :
Template name : NULL                    Template applied at : Default
Min Tx : 300                            Min Rx : 300
Multiplier: 3
```

Bfd authentication : Disabled

BFD GTSM : Disabled

Negotiated parameters :

Neg Tx : 300

Neg Rx : 300

Multiplier: 10

Counters values:

Pkt In : 0000000000000000

Pkt Out : 0000000000000572

Echo Out : 0000000000000000

Session down time : 00:00:00

Session up time : 00:00:00

UP Count : 0

Registered Clients:

Static

Output field	Description
Session Interface Name	Interface for which you are running the command.
Session Index	Number of BFD sessions associated with the system.
Lower Layer	IPv4 or IPv6.
Version	Version of the lower layer.
Session Type	Single hop or multiple hop.
Session State	State of the BFD session: Admin-Down, Down, or Up.
Local Discriminator	Local discriminator for the session.
Local Address	Local address for the session.
Remote Discriminator	Remote discriminator for the session.
Remote Address	Remote address for the session.
Local Port	Source UDP port for the session.
Remote Port	Standard UDP Destination port
Diagnostics	Diagnostics for the current state of the session.
Configured Parameters	
Template name	Name for the parameter template.
Template applied at	Host or interface where the parameter template is applied.
Min Tx	Required minimum transmission time for the BFD session.
Min Rx	Required minimum receiver time for the BFD session.
Multiplier	Detection multiplier for the BFD session.
Bfd GTSM Disabled	Generalized TTL security mechanism (disabled for now).
Bfd Authentication Disabled	BFD authentication type supported.
Negotiated Parameters	
Neg Tx	Negotiated transmission time.
Neg Rx	Negotiated receiver time.
Multiplier	Negotiated multiplier for the BFD session.
Counters values	
Pkt In	IPv4 asynchronous packet receiver count.
Pkt Out	IPv4 asynchronous packet transmission count.
Echo Out	IPv4 Echo packet transmission count.
Session down time	Time since the BFD session went DOWN.
Session up time	Time since the BFD session went UP.
UP Count	Number of times the BFD session has reached the UP state.

Output field	Description
Registered Clients	Client or clients registered for the BFD service.

List of Acronyms

Acronym	Description
ACL	access control list
ADSL	Asymmetric Digital Subscriber Line
AH	Authentication Header
AMI	Amazon Machine Image
API	Application Programming Interface
AS	autonomous system
ARP	Address Resolution Protocol
AWS	Amazon Web Services
BGP	Border Gateway Protocol
BIOS	Basic Input Output System
BPDU	Bridge Protocol Data Unit
CA	certificate authority
CCMP	AES in counter mode with CBC-MAC
CHAP	Challenge Handshake Authentication Protocol
CLI	command-line interface
DDNS	dynamic DNS
DHCP	Dynamic Host Configuration Protocol
DHCPv6	Dynamic Host Configuration Protocol version 6
DLCI	data-link connection identifier
DMI	desktop management interface
DMVPN	dynamic multipoint VPN
DMZ	demilitarized zone
DN	distinguished name
DNS	Domain Name System
DSCP	Differentiated Services Code Point
DSL	Digital Subscriber Line
eBGP	external BGP
EBS	Amazon Elastic Block Storage
EC2	Amazon Elastic Compute Cloud
EGP	Exterior Gateway Protocol
ECMP	equal-cost multipath
ESP	Encapsulating Security Payload
FIB	Forwarding Information Base
FTP	File Transfer Protocol
GRE	Generic Routing Encapsulation
HDLC	High-Level Data Link Control
I/O	Input/Output
ICMP	Internet Control Message Protocol

Acronym	Description
IDS	Intrusion Detection System
IEEE	Institute of Electrical and Electronics Engineers
IGMP	Internet Group Management Protocol
IGP	Interior Gateway Protocol
IPS	Intrusion Protection System
IKE	Internet Key Exchange
IP	Internet Protocol
IPOA	IP over ATM
IPsec	IP Security
IPv4	IP Version 4
IPv6	IP Version 6
ISAKMP	Internet Security Association and Key Management Protocol
ISM	Internet Standard Multicast
ISP	Internet Service Provider
KVM	Kernel-Based Virtual Machine
L2TP	Layer 2 Tunneling Protocol
LACP	Link Aggregation Control Protocol
LAN	local area network
LDAP	Lightweight Directory Access Protocol
LLDP	Link Layer Discovery Protocol
MAC	medium access control
mGRE	multipoint GRE
MIB	Management Information Base
MLD	Multicast Listener Discovery
MLPPP	multilink PPP
MRRU	maximum received reconstructed unit
MTU	maximum transmission unit
NAT	Network Address Translation
NBMA	Non-Broadcast Multi-Access
ND	Neighbor Discovery
NHRP	Next Hop Resolution Protocol
NIC	network interface card
NTP	Network Time Protocol
OSPF	Open Shortest Path First
OSPFv2	OSPF Version 2
OSPFv3	OSPF Version 3
PAM	Pluggable Authentication Module
PAP	Password Authentication Protocol
PAT	Port Address Translation
PCI	peripheral component interconnect
PIM	Protocol Independent Multicast
PIM-DM	PIM Dense Mode

Acronym	Description
PIM-SM	PIM Sparse Mode
PKI	Public Key Infrastructure
PPP	Point-to-Point Protocol
PPPoA	PPP over ATM
PPPoE	PPP over Ethernet
PPTP	Point-to-Point Tunneling Protocol
PTMU	Path Maximum Transfer Unit
PVC	permanent virtual circuit
QoS	quality of service
RADIUS	Remote Authentication Dial-In User Service
RHEL	Red Hat Enterprise Linux
RIB	Routing Information Base
RIP	Routing Information Protocol
RIPng	RIP next generation
RP	Rendezvous Point
RPF	Reverse Path Forwarding
RSA	Rivest, Shamir, and Adleman
Rx	receive
S3	Amazon Simple Storage Service
SLAAC	Stateless Address Auto-Configuration
SNMP	Simple Network Management Protocol
SMTP	Simple Mail Transfer Protocol
SONET	Synchronous Optical Network
SPT	Shortest Path Tree
SSH	Secure Shell
SSID	Service Set Identifier
SSM	Source-Specific Multicast
STP	Spanning Tree Protocol
TACACS+	Terminal Access Controller Access Control System Plus
TBF	Token Bucket Filter
TCP	Transmission Control Protocol
TKIP	Temporal Key Integrity Protocol
ToS	Type of Service
TSS	TCP Maximum Segment Size
Tx	transmit
UDP	User Datagram Protocol
VHD	virtual hard disk
vif	virtual interface
VLAN	virtual LAN
VPC	Amazon virtual private cloud
VPN	virtual private network
VRRP	Virtual Router Redundancy Protocol

Acronym	Description
WAN	wide area network
WAP	wireless access point
WPA	Wired Protected Access