BGP Configuration Guide

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1. Introduction to RtBrick BGP

The RtBrick Full Stack (RBFS) is a distributed, web-scale network operating system based on micro-service architecture and packaged in a Linux container currently based on Ubuntu 18.04. The RBFS decreases the complexity of a network by providing users with capabilities such as composability, programmability, and elasticity in a visionary way.

The RBFS operating system operates on the leaf and spine framework. This framework provides the network operators with methods to configure and manage a network brick by brick, and provides full control of the network so the focus can be on the deployment of the new services and not the constant juggling of hardware.

1.1. BGP Overview

BGP is a standard exterior gateway protocol (EGP) supported by RtBrick. BGP is considered a “Path Vector” routing protocol and maintains a separate routing table based on shortest Autonomous system (AS) path and various other route attributes.

1.2. Supported BGP Standards

RFC Number	Description
RFC 2545	Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing
RFC 2918	Route Refresh Capability for BGP-4
RFC 4271	A Border Gateway Protocol 4 (BGP-4)
RFC 4364	BGP/MPLS IP Virtual Private Networks (VPNs)
RFC 4456	BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)
RFC 4486	Subcodes for BGP Cease Notification Message
RFC 4760	Multiprotocol Extensions for BGP-4
RFC 5492	Capabilities Advertisement with BGP-4
RFC 6793	BGP Support for Four-Octet Autonomous System (AS) Number Space
RFC 6608	Subcodes for BGP Finite State Machine Error
RFC 6774	Distribution of Diverse BGP Paths [Partial Support]

1.3. Supported BGP Features

The RBFS supports the following BGP functions:

- Basic BGP Protocol
- Multiprotocol extension for BGP
- Multipath for iBGP and eBGP
- Four-byte AS numbers
- Nexthop Self or nexthop unchanged
- Fast external-failover
- Route reflection
- MD5 Authentication
- Route refresh
- Advanced route refresh
- Route redistribution
- Multihop EBGP
- Route selection flexibility (always compare MED, ignore AS Path, and so on)
- Add path
- Host name/Domain name
- Dynamic peers
- Community, Extended Community, and Large Community support
- 6PE Support

The statements and commands required to configure and verify the functioning of BGP features are described in this guide.

2. RBFS BGP Instance Hierarchy

The RBFS uses a distinct hierarchy for the BGP statements and commands. When installed, the RBFS runs a default instance named “default.” In most applications, more instances are needed, and many configuration statements apply to various levels of the statement hierarchy.

You can apply BGP configuration statements and commands at the instance, address family, or protocol BGP hierarchy level.

This BGP hierarchy can be represented as:

```
Global BGP Configuration
     - Router ID
     - Local AS
     - Cluster ID
     - Domain Name
     - Host Name
     - Local Preference
     - Out Metric
     - Protocol Preference
     - Timer: Hold Time
     - Timer: Keep Alive
     - Timer: Connect Retry
Instance BGP Address Family Configuration
     - Default-Information Originate
     - Download-Count
     - Multipath
     - Remote AS
     - Local AS
     - EBGP-Multihop
     - Any-AS
Instance BGP Peer-group Address family Configuration
     - Extended Nexthop
     - Update Nexthop
     - Nexthop Unchanged
     - Nexthop Self
     - Default Information Originate
     - Remove Private AS
     - Route Reflector Client
Instance BGP Peer Configuration
```

2.1. Address Family

The address family configured at the instance level determines the types of address families that the virtual routing and forwarding (VRF) instance supports. At this level, you also configure the route target (RT), and the import and export policies for the instance. The forwarding daemon (FWDD) uses these configuration statements to create the VRF tables for each address family. Note that the route distinguisher (RD) is configured under the instance hierarchy level.

At the BGP protocol level, the address family configuration is used to determine which address families BGP supports. Multiple commands exist under this hierarchy level.

At the BGP peer group level, the address family configuration is used to determine which address families are needed to negotiate usage with the other BGP peers in the group.

There is no configuration under the peer hierarchy level. This statement establishes the peer, and all peers must be associated with a peer group. All of the parameters that apply to a peer are determined at the peer-group hierarchy level.

For example, this sequence configures IPv4 unicast support for the vrf1 instance:

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
unicast
```

2.2. Redistribute

BGP determines support for route redistribution based on address family. The selected address family can redistribute local interface routes, static routes, routes learned by IS-IS, and so on. Complete redistribute statement information and examples are included in other sections.

3. BGP Global Configuration Commands

When it comes to BGP configuration, global BGP commands configure the routing instance, and instance BGP commands configure how BGP behaves in the instance.

This describes the BGP global commands. These commands establish the instance, the route distinguisher (RD), and the route target (RT) for BGP to use.

3.1. Instance

Configure and log into the RBFS instance

set instance <instance-name>

Command arguments

<instance-name>	Name of the routing instance

Example

```
root@rtbrick: cfg> set instance ip2vrf
root@rtbrick: cfg> commit
```

3.2. Route Distinguisher

Configure the route distinguisher (RD) to define unique routes within an IPv4 network. Provider Edge (PE) routers use route distinguishers to identify which virtual private network (VPN) a packet belongs to in a PE network.

set instance <instance-name> **rd** <as-number | ipv4-address>:<rd-value>

Command arguments

<instance-name>	Name of the routing instance
<ipv4-address>	The IPv4 address to use for the RD (in dotted decimal format)
<rd-value>	Specifies the route distinguisher value

Example

```
root@rtbrick: cfg> set instance ip2vrf rd 192.1.4.1:65001
root@rtbrick: cfg> commit
```

The following example shows the route-distinguisher configured on an instance.

```
supervisor@ixr_pe1: op> show config instance ip2vrf route-distinguisher
192.0.1.2:1
{
  "rtbrick-config:route-distinguisher": "192.0.1.2:1"
}
supervisor@ixr_pe1: op>
```

3.3. Route Target

Configure the route target (RT) to use to transfer routes between VRFs and VPNs. The RT identifies a subset of routes within the BGP VPNv3 unicast table that should be used in a VRF for a particular customer. You configure an RT for importing or exporting routes, or both.

set instance <instance-name> **address-family** <address-family-afi> <address-family-safi> **rt import target:**<rt-value>

set instance <instance-name> **address-family** <address-family-afi> <address-family-safi> **rt export target:**<rt-value>

Command arguments

import	Use this RT for imported routes
export	Use this RT for exported routes
target:<rt-value>	The value to use for the RT, in the same format as the RD

Example: Configure an RT for import and export routes

```
root@rtbrick: cfg> set instance ip2vrf address-family ipv4 unicast rt import
target:192.1.4.0:11
root@rtbrick: cfg> set instance ip2vrf address-family ipv6 unicast rt import
target:192.1.4.0:21
root@rtbrick: cfg> commit
```

The following example shows an interface where import and export routes are configured.

```
supervisor@ixr_pe1: op> show config instance ip2vrf address-family ipv4
unicast route-target
{
  "rtbrick-config:route-target": {
    "import": "target:192.1.4.0:11",
    "export": "target:192.1.4.0:21"
  }
}
supervisor@ixr_pe1: op>
```

4. BGP Instance Configuration Commands

This section describes the commands used to configure BGP in an instance.

4.1. bgp

You must enable BGP inside an instance before you configure the BGP-specific instance options. When this enable command is successfully executed, the mode is changed from edit to set.

edit protocol bgp

Example: Configure BGP for the vrf1 instance

```
[ edit instance vrf1 ] root@spine1:confd> edit protocol bgp
```

4.2. address-family (and BGP Options)

You must configure the BGP address families if you are using route redistribution, load balancing, or other advanced features. By default, BGP neighbor sessions support IP4v unicast and multicast address families.

set instance <instance-name> **protocol bgp address-family** <address-family-afi> <address-family-safi>

<instance-name>	Name of the instance
<address-family-afi>	Enables the address family identifier (AFI) IPv4 or IPv6
<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast

Example: Enable the IPv4 unicast address family for BGP on the vrf1 instance

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
unicast
root@rtbrick: cfg> commit
```

In addition to the basic family support, you can also configure a number of options.

Supported options, detailed in sections below, are:

default-information	Configure default route information to distribute
download-count	Forward packets over multiple paths, but set maximum prefixes to use
download-policy	Establish a policy for downloading routes
multipath	Enable load sharing among multiple BGP paths
redistribute	Enter redistribution configuration mode
retain-route-target	Retain VPN routes for all route targets
srgb	Establish Segment Routing Global Block for segment routing

You should always configure BGP to distribute a default route.

Example: Configure BGP to distributes a default IPv4 unicast address in the vrf1 instance

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
unicast default-information originate true
root@rtbrick: cfg> commit
```

4.3. download-count

This statement is for temporary use until full routing policy support is configured. Use this statement to configure the number of prefixes that the BGP unicast session can download to the forwarding daemon (FWDD). BGP downloads the attribute information (community, extended community, and as-path) for prefixes to the Routing Information Base (RIB) and Forwarding Information Base (FIB) for advertising.

You can assign counters based on BGP prefixes and attributes on a per-input interface basis.

set protocol bgp address-family <address-family-afi> <address-family-safi> unicast download-count <count-number>

<address-family-afi>	Enables the IPv4 or IPv6 address families
<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast
unicast	BGP distributes unicast routes
download-count	Count prefixes

<count-number>	Number of prefixes to forward over multiple paths

Example: Configure BGP for a maximum of 40 prefixes

```
[ edit instance vrf1 ] root@spine1:confd> set protocol bgp address-family
ipv4 unicast download-count 40
```

4.4. download-policy

Apply the BGP routing policy for downloaded routes. The policy is defined elsewhere.

set protocol bgp address-family <address-family-afi> <address-family-safi> download-policy <policy-name>

<address-family-afi>	Enables the IPv4 or IPv6 address families
<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast
<policy-name>	Name of the policy to apply

The policy is NOT configured here. Routing policy configuration is covered in another chapter.

Example: Configure download policy

```
[edit]
root@spine1:confd> set bgp address-family ipv4 unicast download-policy
fibpolicy
```

4.5. multipath

Allow load sharing among the configured number of multiple Exterior BGP (EBGP) and Internal BGP (IBGP) paths.

set instance protocol bgp address-family <address-family-afi> <address-family-safi> multipath <number-of-paths>

<address-family-afi>	Enables the IPv4 or IPv6 address families

<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast
<number-of-paths>	Number of paths that can be installed in the forwarding table. This is an integer in the range 0 to 255.

Example: Configure multipath for a value of 10 forwarding table entries

```
root@rtbrick: cfg> set instance protocol bgp address-family ipv4 unicast
multipath 10
root@rtbrick: cfg> commit
```

4.6. redistribute

Enable the redistribution feature to dynamically inject routes from a certain protocol into the IP routing table.

set instance <instance> protocol bgp address-family <address-family-afi> <address-family-safi> **redistribute** <source>

<instance>	Name of the routing instance
<address-family-afi>	Enables the IPv4 or IPv6 address families
<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast
<source>	Redistribute routes from this protocol. Protocols can be direct or local interfaces, IS-IS, OSPF, PIM, PPP, or static routes.

IS-IS and OSPF have additional options detailed below.

Example: Configure redistribution on direct routes into BGP.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
unicast redistribute direct
root@rtbrick: cfg> commit
```

4.6.1. IS-IS Redistribute Options

If you configure the redistribution of IS-IS routes, you have the option of testing for a match on either level-1 or level-2 IS-IS routers. The syntax is as follows:

set instance <instance> protocol bgp address-family <address-family-afi> <address-family-safi> **redistribute isis policy-map** <policy-map>

<address-family-afi>	Enables the IPv4 or IPv6 address families
<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast
<policy-map>	Name of the policy map

Example: Configure redistribution for IS-IS Level 1 routes.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
unicast redistribute isis match policy-map policymap1
root@rtbrick: cfg> commit
```

4.6.2. OSPF Redistribute Options

If you configure the redistribution of OSPF routes, you have the option of testing for a match on several types of OSPF routers. The syntax is as follows:

set instance <instance> **protocol bgp address-family** <address-family-afi> <address-family-safi> **redistribute ospf** policy-map <policy-map>

<address-family-afi>	Enables the IPv4 or IPv6 address families
<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast
<policy-map>	Name of the policy map

Example: Configure redistribution for OSPF inter-area routes.

```
[edit]
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
unicast redistribute ospf policy-map policymap1
```

4.7. retain-route-target

By default, the forwarding table retains the VPN routes for all route targets when the roputing protocol process shuts down. If you disable this retention of route targets, the VPN routes are removed from the forwarding table when the routing protocol shuts down.

set instance <instance> **protocol bgp address-family** <address-family-afi>

<address-family-safi> **retain-route-target disable**

<address-family-afi>	Enables the IPv4 or IPv6 address families
<address-family-safi>	Enables the subsequent address family identifier (SAFI) for vpn-unicast (the only family supported)

Example: Configure removal of VPN routes when routing process shuts down.

```
[edit]
root@rtbrick: cfg> set instance ip2vrf bgp address-family ipv4 vpn-unicast
retain-route-target disable
```

4.8. srgb

The Segment Routing Global Block (SRGB) is the range of label values reserved for segment routing (SR). These values are assigned as segment identifiers (SIDs) to SR-enabled network nodes and have global significance throughout the routing domain.

SRGB is supported only for labeled unicast.

You must specify the base starting value for the labels (a number greater than 15), a range for the labels, and an index within the label range.

set instance <instance> **protocol bgp address-family** [<address-family-afi> | <address-family-safi>] **labeled-unicast srgb** (**base** <base-value> | **range** <range-value> | **index** <index-value>)

<address-family-afi>	Enables the IPv4 or IPv6 address families
base <base-value>	Starting base value, greater than 15, of the SRGB values
range <range-value>	Range of label values
index <index-value>	Index within the label range

Example: Configure the SRGB label base to 2000, range to 100, and index to 2 (which selects label 2001 from the zero-based label range).

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
labeled-unicast base 2000 range 100 index 2
root@rtbrick: cfg> commit
```

4.9. cluster-id

Configure cluster ID to associate routers in a group within a BGP routing instance. Routers belong to the same cluster if they have the same cluster ID. The cluster ID is formatted as an IPv4 address.

set instance <instance> **protocol bgp cluster-id** <cluster-identifier>

<cluster-identifier>	An IPv4 address

Example: Configure cluster-id 192.168.1.1 for this BGP instance.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp cluster-id 192.168.1.1
root@rtbrick: cfg> commit
```

4.10. domain-name

Configure the domain name for this BGP routing instance.

set instance <instance> protocol bgp domain-name <domain-name>

<instacne>	Name of the BGP instance
<domain-name>	The name of the BGP routing domain, to a maximum of 64 characters

Example: Configure domain name spine for this BGP instance.

```
root@rtbrick: cfg> set instance default protocol bgp domain-name leaf-1
root@rtbrick: cfg> commit
```

4.11. enforce-first-as

By default, the BGP routing process enforces the First AS feature. This feature discards updates received from an eBGP peer if the peer does not list its own AS number as the first segment in the AS_PATH BGP attribute.

To disable the First AS feature and accept updates without the peer's source AS

matching the first AS in the AS_PATH attribute, configure the feature to disable the enforce First AS feature.

set instance <instance> protocol bgp enforce-first-as disable

<instance>	Name of the BGP instance
disable	Disable the default First AS feature BGP behavior

Example: Configure this BGP instance to disable the First AS feature.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp enforce-first-as disable
root@rtbrick: cfg> commit
```

4.12. host-name

Configure a host name for BGP to use.

set instance <instance> protocol bgp host-name <host-name>

<instance>	Name of the BGP instance
<host-name>	The name of the BGP host, to a maximum of 64 characters

Example: Configure this BGP instance to use host name spine1.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp host-name pod1-leaf1-
ip2vrf-instance
root@rtbrick: cfg> commit
```

4.13. local-as

Configure the local AS number in four-byte format for BGP to use.

set instance <instance> protocol bgp local-as <as4-number>

<instance>	Name of the routing instance
<as4-number>	The AS number in four-byte format. The numbers allowed are from 1 to 4294967285

Example: Configure this BGP instance to use local AS Number 65001.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp local-as 65004
root@rtbrick: cfg> commit
```

4.14. local-preference

Configure the value to use as BGP local preference. You can use the local AS preference number to choose the exit path for an AS.

set instance <instance> protocol bgp local-preference <preference-number>

<preference-number>	The local preference number for the BGP protocol. The numbers allowed are from 0 to 4294967285

Example: Configure this BGP instance to use local preference 150.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp local-preference 150
root@rtbrick: cfg> commit
```

4.15. out-metric

Configure the value to use as BGP Multi-Exit Discriminator (MED) value. When an AS has multiple links to another AS, the MED value is used to determine the exit to use to reach the other AS.

set instance <instance> **protocol bgp out-metric** <med-value>

<instance>	Name of the BGP instance
<med-value>	The MED value for the BGP protocol. The numbers allowed are from 0 to 4294967285

Example: Configure this BGP instance to use MED 10.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp out-metric 10
root@rtbrick: cfg> commit
```

4.16. protocol-preference

Assign a protocol preference distance value to routes learned by eBGP, iBGP, or both.

set instance <instance> protocol bgp protocol-preference (internal | external) <preference-value>

<instance>	Name of the BGP instance
internal	Use this distance value preference for routes learned by iBGP
external	Use this distance value preference for routes learned by eBGP
<preference-value>	Use this distance value as BGP route protocol preference

Example: Configure this BGP instance to use a value of 50 for eBGP routes and a value of 100 for iBPG routes.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp protocol-preference
external 50
root@rtbrick: cfg> set instance ip2vrf protocol bgp protocol-preference
internal 100
root@rtbrick: cfg> commit
```

4.17. router-id

Configure the value used as the router ID.

set instance <instance> protocol bgp router-id <router-id>

<instance>	Name of the BGP instance
<router-id>	Router identifier in IPv4 format

Example: Configure the router identifier to be 192.168.1.1.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp router-id 192.168.1.1
root@rtbrick: cfg> commit
```

4.18. timer

Configure the timer value used to keep the router active.

set instance <instance> **protocol bgp timer hold-time** <seconds>

set instance <instance> **protocol bgp timer keep-alive** <seconds>

<seconds>	Time in seconds. The valid range is 5 to 65535

Example: Configure the router connect retry to 15 seconds, and the hold-time to 60 seconds.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp timer keep-alive 30
root@rtbrick: cfg> commit
```

4.19. type-of-service

Configure the value for the type-of-service (DSCP) bits.

set instance <instance> **protocol bgp type-of-service cost** <low|normal>

set instance <instance> **protocol bgp type-of-service delay** <low|normal>

set instance <instance> **protocol bgp type-of-service precedence** <precedence>

set instance <instance> **protocol bgp type-of-service reliability** <high|normal>

set instance <instance> **protocol bgp type-of-service throughput** <high|normal>

```
root@spine1:confd> set instance ip2vrf protocol bgp type-of-service delay 32
root@rtbrick: cfg> commit
```

4.20. peer-group

Configure a name for a peer group of BGP routers. Neighbor peers with the same update policies can be grouped as peers (equals) to simplify the initial configuration and updates. Peers share the same policies such as route maps, distribution lists, filter lists, update source, and so on, so peer groups only need one configuration statement for these values.

set instance <instance> **protocol bgp peer-group** <peer-group-name> (address-family <address-family-afi> | any-as <true|false> | ebgp-multihop <hop-count> | link-local-nexthop-only <true|false> | local-as <as-number> | remote-as <as-number>)

<instance>	Name of the BGP instance
<peer-group-name>	Name of the peer group
address-family <address-family-afi> <address-family-safi>	Configure to address family AFI and SAFI for the peer group (for supported AFI and SAFI values, see the address-family BGP configuration statement)

any-as	Enable dynamic AS negotiation for this peer group
ebgp-multihop <hop-count>	By default, the maximum number of hops between eBGP peers is 1 (direct connection). This hop count overrides the default behavior allow connectivity between eBGP peers not directly connected.
link-local-nexthop-only	Enable link-local nexthop only feature
local-as	Configure local AS number
remote-as	Configure remote AS number

Example: Configure the BGP peer as spine and enable dynamic negotiation of the AS number, sets the eBGP multihop count to 3, and set the number of additional paths sent to the peer group to 20.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp peer-group spine any-as
root@rtbrick: cfg> set instance ip2vrf protocol bgp peer-group spine ebgp-
multihop 3
root@rtbrick: cfg> set instance ip2vrf protocol bgp peer-group spine add-path
20 send-only
root@rtbrick: cfg> commit
```

The full set of address family names is listed under the address-family configuration statement.

4.21. address-family (peer-group)

You must configure the BGP address families for a peer-group if you are using route redistribution, load balancing, or other advanced features. Note: The advanced features are NOT configured here, but under the BGP instance. By default, BGP neighbor sessions support IP4v unicast and multicast address families.

set instance <instance> protocol bgp peer-group <peer-group-name> address-family <address-family-afi> <address-family-safi> [options]

<instance>	Name of the BGP instance
<peer-group-name>	Name of the peer group supporting these families
<address-family-afi>	Enables the address family identifier (AFI) IPv4 or IPv6
<address-family-safi>	Enables the subsequent address family identifier (SAFI) options: unicast, labeled-unicast, or vpn-unicast

Additional options:

add-path	Negotiate additional path capabilities with these peers, so that more than one path can be active to the peers in the group
default-information	Enable default route information to be sent to peers in group
extended-nexthop	Enable extended nexthop capability so that peers in the group do not have to be directly connected
(nexthop-self | nexthop-unchanged)	Propagate nexthop self or nexthop unchanged for advertised paths
policy	Apply a routing policy to the peer group
remove-private-as	Remove private AS numbers from routes advertised to group peers
route-reflect-client	Configure this peer as a route reflector client
update-nexthop	Update the nexthop for routes advertised to this peer group

Example: Enable the IPv4 unicast address family for BGP on the vrf1 instance and make the peer a route-reflector client

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv4
unicast route-reflect-client
root@rtbrick: cfg> commit
```

4.22. peer

Configure parameters for a, IPv4 or IPv6 BGP peer. A BGP peer is a BGP router that has an active TCP connection to another BGP router. To establish point-to-point connections between peer autonomous systems (ASs) for eBGP or within the AS for iBGP, you configure a BGP session on an interface. When you configure a BGP peer, the configuration adds the IP address of the peer in the specified autonomous system to the multiprotocol BGP (mBPG) neighbor table maintained in the local router.

set instance <instance> **protocol bgp peer** (ipv4 | ipv6) <peer-address> <update-source> peer-group <peer-group-name>

instance	Name of the BGP instance
(ipv4 | ipv6)	Configure either an IPv4 or IPv6 BGP peer
peer-address <ip-address>	Configure the peer IPv4 or IPv6 address. You cannot use this option with the interface option below.
update-source <ip-address>	Configure an IP address to use as the source for packets sent to the peer address

peer-group <peer-group-name>	Assign this peer to this peer group

The peer-address and interface options are mutually exclusive. In other words, you cannot locate a peer by both interface and address; only one or the other.

There are three main peer types to configure:

- IPv4 peers
- IPv6 peers
- IPv6 link local peers (dynamic peers)

Each type has a general peer configuration format associated with it:

- (IPv4 peer) set instance protocol bgp peer ipv4 peer-address <ipv4-address> update-source <ipv4-address> peer-group <group-name>
- (IPv6 peer) set instance protocol bgp peer ipv6 peer-address <ipv6-address> update-source <ipv6-address> peer-group <group-name>
- (IPv6 link-local dynamic peer) set instance protocol bgp peer interface <interface-name> peer-group <group-name> Note that IP6v link-local peers configure the interface. The following examples configure a peer of each type.

Example 1: Configure an IPv4 BGP peer and assign the peer to the spine peer group.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp peer ipv4 192.168.1.1
192.168.1.2 peer-group spine
root@rtbrick: cfg> commit
```

Example 2: Configure an IPv6 peer and assign the peer to the spine peer group.

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp peer ipv6 1::1 1::2 peer-
group spine
root@rtbrick: cfg> commit
```

Example 3: Configure an IPv6 dynamic peer on interface ifl-0/0/1/1/1 and assign the peer to peer group spine.

```
root@rtbrick: cfg> set instance protocol bgp peer interface ifl-0/0/1/1/1
peer-group spine
root@rtbrick: cfg> commit
```

5. BGP Show Commands

5.1. BGP Summary

5.1.1. show bgp summary

This command displays BGP summary information for all instances.

```
supervisor@rtbrick: op> show bgp summary
Instance: default
  General information
    Hostname: PE1, Domain name:
    Local AS: 1000, Version: 4
    Local preference: 100, Protocol preference: 200
    Router ID: 192.0.0.2, Cluster ID: 192.0.0.2
  Capabilities
    Route refresh: True, AS4: True, Graceful restart: False
  Best route selection
    Always compare MED: False, Ignore as path: False
    Ignore local preference: False, Ignore origin: False
    Ignore MED: False, Ignore route source: False
    Ignore router ID: False, Ignore uptime: True
    Ignore cluster length: False, Ignore peer IP: False
    Route select parameter: 0
  Timers
    Connect retry: 30s, Keepalive: 30s, Holdtime: 90s
  Statistics
    Peers configured: 1, Peers auto discovery: 0
      Peers in idle          : 0
      Peers in connect       : 0
      Peers in active        : 0
      Peers in opensent      : 0
      Peers in openconfirm   : 0
      Peers in established   : 1
Instance: ip2vrf
  General information
    Hostname: pe1-ip2vrf, Domain name:
    Local AS: 65535, Version: 4
    Local preference: 100, Protocol preference: 200
    Router ID: 192.0.1.2, Cluster ID: 192.0.1.2
  Capabilities
    Route refresh: True, AS4: True, Graceful restart: False
  Best route selection
    Always compare MED: False, Ignore as path: False
    Ignore local preference: False, Ignore origin: False
    Ignore MED: False, Ignore route source: False
    Ignore router ID: False, Ignore uptime: True
    Ignore cluster length: False, Ignore peer IP: False
    Route select parameter: 0
  Timers
    Connect retry: 30s, Keepalive: 30s, Holdtime: 90s
  Statistics
    Peers configured: 2, Peers auto discovery: 0
      Peers in idle          : 0
      Peers in connect       : 0
      Peers in active        : 0
      Peers in opensent      : 0
      Peers in openconfirm   : 0
      Peers in established   : 2
supervisor@rtbrick: op>
```

5.1.2. show bgp summary instance default

This command displays BGP summary information of the default instance.

```
supervisor@rtbrick: op> show bgp summary instance default
Instance: default
  General information
    Hostname: PE1, Domain name:
    Local AS: 1000, Version: 4
    Local preference: 100, Protocol preference: 200
    Router ID: 192.0.0.2, Cluster ID: 192.0.0.2
  Capabilities
    Route refresh: True, AS4: True, Graceful restart: False
  Best route selection
    Always compare MED: False, Ignore as path: False
    Ignore local preference: False, Ignore origin: False
    Ignore MED: False, Ignore route source: False
    Ignore router ID: False, Ignore uptime: True
    Ignore cluster length: False, Ignore peer IP: False
    Route select parameter: 0
  Timers
    Connect retry: 30s, Keepalive: 30s, Holdtime: 90s
  Statistics
    Peers configured: 1, Peers auto discovery: 0
      Peers in idle          : 0
      Peers in connect       : 0
      Peers in active        : 0
      Peers in opensent      : 0
      Peers in openconfirm   : 0
      Peers in established   : 1
```

5.2. BGP FIB

5.2.1. show bgp fib

This command displays information of the BGP forwarding table for all instances.

```
supervisor@rtbrick: op> show bgp fib
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Prefix                                          Preference      Out Label
Next Hop
  10.0.0.1/32                                     200             -
12.0.0.1
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Prefix                                          Preference      Out Label
Next Hop
  12.0.0.0/24                                     200             20002,bos:1
  10.0.0.1/32                                     200             20002,bos:1
  192.0.1.2/32                                    200             20002,bos:1
  34.0.0.0/24                                     20              20005,bos:1
192::3
  10.0.0.4/32                                     20              20005,bos:1
192::3
  192.0.1.3/32                                    20              20005,bos:1
192::3
  192.0.4.10/32                                   20              20005,bos:1
192::3
Instance: default, AFI: ipv6, SAFI: unicast
  Prefix                                          Preference      Out Label
Next Hop
  192::3/128                                      20                 -
23.0.0.3
  192::10/128                                     20                -
23.0.0.3
```

5.2.2. show bgp fib ipv6

This command displays information of the BGP forwarding table for the IPv6 addresses for all instances.

```
supervisor@rtbrick: op> show bgp fib ipv6
Instance: default, AFI: ipv6, SAFI: unicast
  Prefix                                          Preference      Out Label
Next Hop
  192::3/128                                      20              -
23.0.0.3
  192::10/128                                     20              -
23.0.0.3
Instance: ip2vrf, AFI: ipv6, SAFI: unicast
  Prefix                                          Preference      Out Label
Next Hop
  10::1/128                                       200             -
12::1
Instance: default, AFI: ipv6, SAFI: labeled-unicast
  Prefix                                          Preference      Out Label
Next Hop
  192::3/128                                      20              2003
23.0.0.3
  192::10/128                                     20              2003
23.0.0.3
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix                                          Preference      Out Label
Next Hop
  12::/64                                         200             20003,bos:1
  10::1/128                                       200             20003,bos:1
  192:0:1::2/128                                  200             20003,bos:1
  34::/64                                         20              20006,bos:1
192::3
  10::4/128                                       20              20006,bos:1
192::3
  192:0:1::3/128                                  20              20006,bos:1
192::3
  192:0:4::10/128                                 20              20006,bos:1
192::3
```

5.2.3. show bgp fib ipv6 vpn-unicast

This command displays information of the BGP forwarding table for the IPv6 vpn-unicast addresses on all instances.

```
supervisor@rtbrick: op> show bgp fib ipv6 vpn-unicast
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix                                          Preference      Out Label
Next Hop
  12::/64                                         200             20003,bos:1
  10::1/128                                       200             20003,bos:1
  192:0:1::2/128                                  200             20003,bos:1
  34::/64                                         20              20006,bos:1
192::3
  10::4/128                                       20              20006,bos:1
192::3
  192:0:1::3/128                                  20              20006,bos:1
192::3
  192:0:4::10/128                                 20              20006,bos:1
192::3
```

5.2.4. show bgp fib ipv6 vpn-unicast detail

This command displays detailed information of the BGP forwarding table for the IPv6 vpn-unicast addresses on all instances.

```
supervisor@rtbrick: op> show bgp fib ipv6 vpn-unicast detail
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix: 12::/64
    Next hop key: 2b38f6f1d2ae56178666d1edcffd18a85fd4509bcac9a21f
    Peer: None, Peer domain: None
    Route source: bgp-local, Send path ID: 405188370, Received path ID: None,
Path hash: None
    As path: None, Originator ID: None, Origin: Incomplete
    Community: None
    Extended community: ['target:192.0.1.2:2']
    Cluster list: None
    IGP metric: None, Local preference: 100, Multi exit discriminator: 0
    Preference: 200, External route: None, Readvertised route: None
    Label: 20003,bos:1, Route up: None
  Prefix: 10::1/128
    Next hop key: 62b6c375c2ee2cb053bd5482ec1b7df18e271b6e0d37a4b0
    Peer: None, Peer domain: None
    Route source: bgp-local, Send path ID: 2400017309, Received path ID:
None, Path hash: None
    As path: None, Originator ID: None, Origin: Incomplete
    Community: None
    Extended community: ['target:192.0.1.2:2']
    Cluster list: None
    IGP metric: None, Local preference: 100, Multi exit discriminator: None
    Preference: 200, External route: None, Readvertised route: None
    Label: 20003,bos:1, Route up: None
```

5.2.5. show bgp fib ipv6 vpn-unicast instance default

This command displays information of the BGP forwarding table for the IPv6 vpn-

unicast addresses for the default instance.

```
supervisor@rtbrick: op> show bgp fib ipv6 vpn-unicast instance default
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix                                          Preference      Out Label
Next Hop
  12::/64                                         200             20003,bos:1
  10::1/128                                       200             20003,bos:1
  192:0:1::2/128                                  200             20003,bos:1
  34::/64                                         20              20006,bos:1
192::3
  10::4/128                                       20              20006,bos:1
192::3
  192:0:1::3/128                                  20              20006,bos:1
192::3
  192:0:4::10/128                                 20              20006,bos:1
192::3
```

5.2.6. show bgp fib ipv6 vpn-unicast instance default detail

This command displays detailed information of the BGP forwarding table for the IPv6 vpn-unicast addresses for the default instance.

```
supervisor@rtbrick: op> show bgp fib ipv6 vpn-unicast instance default detail
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix: 12::/64
    Next hop key: 2b38f6f1d2ae56178666d1edcffd18a85fd4509bcac9a21f
    Peer: None, Peer domain: None
    Route source: bgp-local, Send path ID: 405188370, Received path ID: None,
Path hash: None
    As path: None, Originator ID: None, Origin: Incomplete
    Community: None
    Extended community: ['target:192.0.1.2:2']
    Cluster list: None
    IGP metric: None, Local preference: 100, Multi exit discriminator: 0
    Preference: 200, External route: None, Readvertised route: None
    Label: 20003,bos:1, Route up: None
  Prefix: 10::1/128
    Next hop key: 62b6c375c2ee2cb053bd5482ec1b7df18e271b6e0d37a4b0
    Peer: None, Peer domain: None
    Route source: bgp-local, Send path ID: 2400017309, Received path ID:
None, Path hash: None
    As path: None, Originator ID: None, Origin: Incomplete
    Community: None
    Extended community: ['target:192.0.1.2:2']
    Cluster list: None
    IGP metric: None, Local preference: 100, Multi exit discriminator: None
    Preference: 200, External route: None, Readvertised route: None
    Label: 20003,bos:1, Route up: None
```

5.2.7. show bgp fib ipv6 vpn-unicast <IPv6 address>

This command displays information of the BGP forwarding table for the specified IPv6 vpn-unicast address on all instances.

```
supervisor@rtbrick: op> show bgp fib ipv6 vpn-unicast 34::/64
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix: 34::/64 , Next hop: 192::3
    Next hop key: None
    Peer: None, Peer domain: None
    Route source: bgp, Send path ID: 766304403, Received path ID: None, Path
hash: None
    As path: 2000, Originator ID: None, Origin: Incomplete
h
    Extended community: None
    Cluster list: None
    IGP metric: None, Local preference: None, Multi exit discriminator: 0
    Preference: 20, External route: None, Readvertised route: None
    Label: 20003,bos:1, Route up: None
```

5.3. BGP Peer

5.3.1. show bgp peer

This command displays information of the BGP peers for all instances.

```
supervisor@rtbrick: op> show bgp peer
Instance: default
  Peer                                      Remote AS    State         Up/Down
Time               PfxRcvd              PfxSent
  PE2                                       2000         Established
11d:22h:18m:30s            12                   20
Instance: ip2vrf
  Peer                                      Remote AS    State         Up/Down
Time               PfxRcvd              PfxSent
  CE1                                       65535        Established
6d:02h:28m:02s             2                    2
  CE1                                       65535        Established
6d:02h:27m:45s             2                    2
supervisor@rtbrick: op>
```

5.3.2. show bgp peer detail

This command displays detailed information of the BGP peers for all instances.

```
supervisor@rtbrick: op> show bgp peer detail
Peer: PE2, Peer IP: 23.0.0.3, Remote AS: 2000, Local: 23.0.0.2, Local AS:
1000, Any AS: False
  Type: ebgp, State: Established, Uptime: 11d:22h:18m:48s, Reason: Cease,
```

```
Sub-Code: Admin shutdown
  Discovered on interface: -
  Last transition: Thu Nov 19 05:33:28 GMT +0000 2020, Flap count: 1
  Peer ID        : 192.0.0.10, Local ID  : 192.0.0.2
  Instance       : default, Peer group: to_pe2
  6PE enabled    : False
  Timer values:
    Peer keepalive : 30s, Local keepalive: 30s
    Peer holddown  : 90s, Local holddown : 90s
    Connect retry  : 30s
  Timers:
    Connect retry timer : 0s
    keepalive timer     : expires in 1s 488011us
    Holddown timer      : expires in 1m 15s 85437us
  NLRIs:
    Sent           : ['ipv6-unicast', 'ipv4-vpn-unicast', 'ipv6-vpn-unicast',
'ipv6-labeled-unicast']
    Received       : ['ipv6-unicast', 'ipv6-labeled-unicast', 'ipv4-vpn-
unicast', 'ipv6-vpn-unicast']
    Negotiated     : ['ipv6-unicast', 'ipv6-labeled-unicast', 'ipv4-vpn-
unicast', 'ipv6-vpn-unicast']
  Capabilities:
    Addpath sent                  : None
    Addpath received              : None
    Addpath negotiated            : None
    Extended nexthop sent         : ['ipv4-vpn-unicast']
    Extended nexthop received     : ['ipv4-vpn-unicast']
    Extended nexthop negotiated   : ['ipv4-vpn-unicast']
    Capabilities:
      Feature                      Sent            Received        Negotiated
      Route refresh                True            True            True
      4 byte AS                    True            True            True
      Graceful restart             False           False           False
      Link local only              False           False           False
  End of RIB:
    Address family                 Sent
Received
    IPv4 unicast                   never                                 never
    IPv4 labeled-unicast           never                                 never
    IPv6 unicast                   Thu Nov 19 05:33:30 GMT +0000 2020  Thu
Nov 19 05:33:30 GMT +0000 2020
    IPv6 labeled-unicast           Thu Nov 19 05:33:30 GMT +0000 2020  Thu
Nov 19 05:33:30 GMT +0000 2020
    IPv4 VPN-unicast               Thu Nov 19 05:33:30 GMT +0000 2020  Thu
Nov 19 05:33:30 GMT +0000 2020
    IPv6 VPN-unicast               Thu Nov 19 05:33:30 GMT +0000 2020  Thu
Nov 19 05:33:30 GMT +0000 2020
    IPv4 VPN-multicast             never                                 never
  Message stats:
    Session stats:
      Direction   Open         Update       Keepalive    Notify       Route
refresh
      Input       1            38           41196        0            0
      Output      1            22           41207        0            0
    Total stats:
      Input       2            48           44618        1            0
      Output      3            32           44624        0            0
    Route stats:
```

```
      Address family                  Received     Sent
      IPv4 unicast                    0            0
      IPv4 labeled-unicast            0            0
      IPv6 unicast                    2            3
      IPv6 labeled-unicast            2            3
      IPv4 VPN-unicast                4            7
      IPv6 VPN-unicast                4            7
      IPv4 multicast                  0            0
      IPv4 VPN-multicast              0            0
Peer: CE1, Peer IP: 12.0.0.1, Remote AS: 65535, Local: 12.0.0.2, Local AS:
65535, Any AS: False
  Type: ibgp, State: Established, Uptime: 6d:02h:28m:20s, Reason: Holddown
Timer Error, Sub-Code: Unspecified
  Discovered on interface: -
  Last transition: Wed Nov 25 01:23:56 GMT +0000 2020, Flap count: 1
  Peer ID        : 10.0.0.1, Local ID  : 192.0.1.2
  Instance       : ip2vrf, Peer group: v4_pg
  6PE enabled    : False
  Timer values:
    Peer keepalive : 30s, Local keepalive: 30s
    Peer holddown  : 90s, Local holddown : 90s
    Connect retry  : 30s
  Timers:
    Connect retry timer : 0s
    keepalive timer     : expires in 23s 76657us
    Holddown timer      : expires in 1m 24s 563595us
  NLRIs:
    Sent           : ['ipv4-unicast']
    Received       : ['ipv4-unicast']
    Negotiated     : ['ipv4-unicast']
  Capabilities:
    Addpath sent                  : None
    Addpath received              : None
    Addpath negotiated            : None
    Extended nexthop sent         : None
    Extended nexthop received     : None
    Extended nexthop negotiated   : None
    Capabilities:
      Feature                      Sent            Received        Negotiated
      Route refresh                True            True            True
      4 byte AS                    True            True            True
      Graceful restart             False           False           False
      Link local only              False           False           False
  End of RIB:
    Address family                 Sent
Received
    IPv4 unicast                   Wed Nov 25 01:23:58 GMT +0000 2020  Wed
Nov 25 01:23:57 GMT +0000 2020
    IPv4 labeled-unicast           never                                 never
    IPv6 unicast                   never                                 never
    IPv6 labeled-unicast           never                                 never
    IPv4 VPN-unicast               never                                 never
    IPv6 VPN-unicast               never                                 never
    IPv4 VPN-multicast             never                                 never
  Message stats:
    Session stats:
      Direction   Open         Update       Keepalive    Notify       Route
refresh
```

```
      Input       1            3            21072        0            0
      Output      1            3            21076        0            0
    Total stats:
      Input       2            6            44627        0            0
      Output      2            10           44632        1            0
    Route stats:
      Address family                 Received     Sent
      IPv4 unicast                   2            2
      IPv4 labeled-unicast           0            0
      IPv6 unicast                   0            0
      IPv6 labeled-unicast           0            0
      IPv4 VPN-unicast               0            0
      IPv6 VPN-unicast               0            0
      IPv4 multicast                 0            0
      IPv4 VPN-multicast             0            0
```

5.3.3. show bgp peer instance <instance>

This command displays information of the BGP peers for the specified instance.

```
supervisor@rtbrick: op> show bgp peer instance ip2vrf
Instance: ip2vrf
  Peer                                      Remote AS    State         Up/Down
Time               PfxRcvd              PfxSent
  CE1                                       65535        Established
6d:02h:29m:39s             2                   2
  CE1                                       65535        Established
6d:02h:29m:22s             2                   2
          2                   4
supervisor@rtbrick: op>
```

5.3.4. show bgp peer instance <instance> detail

This command displays detailed information of the BGP peers for the specified instance.

```
supervisor@rtbrick: op> show bgp peer instance ip2vrf detail
Peer: CE1, Peer IP: 12.0.0.1, Remote AS: 65535, Local: 12.0.0.2, Local AS:
65535, Any AS: False
  Type: ibgp, State: Established, Uptime: 6d:02h:30m:02s, Reason: Holddown
Timer Error, Sub-Code: Unspecified
  Discovered on interface: -
  Last transition: Wed Nov 25 01:23:56 GMT +0000 2020, Flap count: 1
  Peer ID        : 10.0.0.1, Local ID  : 192.0.1.2
  Instance       : ip2vrf, Peer group: v4_pg
  6PE enabled    : False
  Timer values:
    Peer keepalive : 30s, Local keepalive: 30s
    Peer holddown  : 90s, Local holddown : 90s
    Connect retry  : 30s
  Timers:
    Connect retry timer : 0s
```

```
    keepalive timer      : expires in 19s 468770us
    Holddown timer       : expires in 1m 28s 896102us
  NLRIs:
    Sent           : ['ipv4-unicast']
    Received       : ['ipv4-unicast']
    Negotiated     : ['ipv4-unicast']
  Capabilities:
    Addpath sent                  : None
    Addpath received              : None
    Addpath negotiated            : None
    Extended nexthop sent         : None
    Extended nexthop received     : None
    Extended nexthop negotiated   : None
    Capabilities:
      Feature                      Sent            Received        Negotiated
      Route refresh                True            True            True
      4 byte AS                    True            True            True
      Graceful restart             False           False           False
      Link local only              False           False           False
  End of RIB:
    Address family                 Sent
Received
    IPv4 unicast                   Wed Nov 25 01:23:58 GMT +0000 2020  Wed
Nov 25 01:23:57 GMT +0000 2020
    IPv4 labeled-unicast           never                                 never
    IPv6 unicast                   never                                 never
    IPv6 labeled-unicast           never                                 never
    IPv4 VPN-unicast               never                                 never
    IPv6 VPN-unicast               never                                 never
    IPv4 VPN-multicast             never                                 never
  Message stats:
    Session stats:
      Direction   Open         Update       Keepalive    Notify       Route
refresh
      Input       1            3            21076        0            0
      Output      1            3            21080        0            0
    Total stats:
      Input       2            6            44631        0            0
      Output      2            10           44636        1            0
    Route stats:
      Address family                 Received     Sent
      IPv4 unicast                   2            2
      IPv4 labeled-unicast           0            0
      IPv6 unicast                   0            0
      IPv6 labeled-unicast           0            0
      IPv4 VPN-unicast               0            0
      IPv6 VPN-unicast               0            0
      IPv4 multicast                 0            0
      IPv4 VPN-multicast             0            0
```

5.3.5. show bgp peer instance <instance> detail address <ip_address>

This command displays detailed information of the BGP peers for the specified instance and address.

```
supervisor@rtbrick: op> show bgp peer instance ip2vrf detail address 12::1
Peer: CE1, Peer IP: 12::1, Remote AS: 65535, Local: 12::2, Local AS: 65535,
Any AS: False
  Type: ibgp, State: Established, Uptime: , Reason: Holddown Timer Error,
Sub-Code: Unspecified
  Discovered on interface: -
  Last transition: Wed Nov 25 01:24:13 GMT +0000 2020, Flap count: 2
  Peer ID        : 10.0.0.1, Local ID  : 192.0.1.2
  Instance       : ip2vrf, Peer group: v6_pg
  6PE enabled    : False
  Timer values:
    Peer keepalive : 30s, Local keepalive: 30s
    Peer holddown  : 90s, Local holddown : 90s
    Connect retry  : 30s
  Timers:
    Connect retry timer : 0s
    keepalive timer     : expires in 22s 98752us
    Holddown timer      : expires in 1m 12s 841186us
  NLRIs:
    Sent           : ['ipv6-unicast']
    Received       : ['ipv6-unicast']
    Negotiated     : ['ipv6-unicast']
  Capabilities:
    Addpath sent                  : None
    Addpath received              : None
    Addpath negotiated            : None
    Extended nexthop sent         : None
    Extended nexthop received     : None
    Extended nexthop negotiated   : None
    Capabilities:
      Feature                      Sent            Received        Negotiated
      Route refresh                True            True            True
      4 byte AS                    True            True            True
      Graceful restart             False           False           False
      Link local only              False           False           False
  End of RIB:
    Address family                 Sent
Received
    IPv4 unicast                   never                                 never
    IPv4 labeled-unicast           never                                 never
    IPv6 unicast                   Wed Nov 25 01:24:15 GMT +0000 2020  Wed
Nov 25 01:24:15 GMT +0000 2020
    IPv6 labeled-unicast           never                                 never
    IPv4 VPN-unicast               never                                 never
    IPv6 VPN-unicast               never                                 never
    IPv4 VPN-multicast             never                                 never
  Message stats:
    Session stats:
      Direction   Open         Update       Keepalive    Notify       Route
refresh
      Input       1            3            21098        0            0
      Output      1            3            21097        0            0
    Total stats:
      Input       3            6            44674        0            0
      Output      3            13           44666        1            0
    Route stats:
```

```
      Address family                  Received     Sent
      IPv4 unicast                    0            0
      IPv4 labeled-unicast            0            0
      IPv6 unicast                    2            2
      IPv6 labeled-unicast            0            0
      IPv4 VPN-unicast                0            0
      IPv6 VPN-unicast                0            0
      IPv4 multicast                  0            0
      IPv4 VPN-multicast              0            0
supervisor@rtbrick: op>
```

5.3.6. show bgp peer address <ip_address>

This command displays information of the BGP peers for the specified address on all instances.

```
supervisor@rtbrick: op> show bgp peer address 12.0.0.1
Peer: CE1, Peer IP: 12.0.0.1, Remote AS: 65535, Local: 12.0.0.2, Local AS:
65535, Any AS: False
  Type: ibgp, State: Established, Uptime: , Reason: Holddown Timer Error,
Sub-Code: Unspecified
  Discovered on interface: -
  Last transition: Wed Nov 25 01:23:56 GMT +0000 2020, Flap count: 1
  Peer ID        : 10.0.0.1, Local ID  : 192.0.1.2
  Instance       : ip2vrf, Peer group: v4_pg
  6PE enabled    : False
  Timer values:
    Peer keepalive : 30s, Local keepalive: 30s
    Peer holddown  : 90s, Local holddown : 90s
    Connect retry  : 30s
  Timers:
    Connect retry timer : 0s
    keepalive timer     : expires in 7s 339130us
    Holddown timer      : expires in 1m 9s 109734us
  NLRIs:
    Sent           : ['ipv4-unicast']
    Received       : ['ipv4-unicast']
    Negotiated     : ['ipv4-unicast']
  Capabilities:
    Addpath sent                  : None
    Addpath received              : None
    Addpath negotiated            : None
    Extended nexthop sent         : None
    Extended nexthop received     : None
    Extended nexthop negotiated   : None
    Capabilities:
      Feature                      Sent            Received        Negotiated
      Route refresh                True            True            True
      4 byte AS                    True            True            True
      Graceful restart             False           False           False
      Link local only              False           False           False
  End of RIB:
    Address family                 Sent
Received
    IPv4 unicast                   Wed Nov 25 01:23:58 GMT +0000 2020  Wed
```

```
Nov 25 01:23:57 GMT +0000 2020
    IPv4 labeled-unicast           never                                 never
    IPv6 unicast                   never                                 never
    IPv6 labeled-unicast           never                                 never
    IPv4 VPN-unicast               never                                 never
    IPv6 VPN-unicast               never                                 never
    IPv4 VPN-multicast             never                                 never
  Message stats:
    Session stats:
      Direction   Open         Update       Keepalive    Notify       Route
refresh
      Input       1            3            21079        0            0
      Output      1            3            21083        0            0
    Total stats:
      Input       2            6            44634        0            0
      Output      2            10           44639        1            0
    Route stats:
      Address family                 Received     Sent
      IPv4 unicast                   2            2
      IPv4 labeled-unicast           0            0
      IPv6 unicast                   0            0
      IPv6 labeled-unicast           0            0
      IPv4 VPN-unicast               0            0
      IPv6 VPN-unicast               0            0
      IPv4 multicast                 0            0
      IPv4 VPN-multicast             0            0
supervisor@rtbrick: op>
```

5.3.7. show bgp peer-group

This command displays information of the BGP peer groups for all instances.

```
supervisor@rtbrick: op> show bgp peer-group
Instance: default
  Peer group name       : to_pe2
    Remote AS           : 2000
    Import rule         : None
    Export rule         : None
    Remove AS           : None
    Nexthop self        : None
    Multipath iBGP      : None
    Multipath eBGP      : None
    Client-to-Client    : None
    Add path            : None
    eBGP multihop       : None
    Hop (TTL)           : None
    Any AS              : None
    Update VPNv4 NH     : None
    Update MVPN NH      : None
Instance: ip2vrf
  Peer group name       : v4_pg
    Remote AS           : 65535
    Import rule         : None
    Export rule         : None
    Remove AS           : None
    Nexthop self        : None
    Multipath iBGP      : None
    Multipath eBGP      : None
    Client-to-Client    : None
    Add path            : None
    eBGP multihop       : None
    Hop (TTL)           : None
    Any AS              : None
    Update VPNv4 NH     : None
    Update MVPN NH      : None
  Peer group name       : v6_pg
    Remote AS           : 65535
    Import rule         : None
    Export rule         : None
    Remove AS           : None
    Nexthop self        : None
    Multipath iBGP      : None
    Multipath eBGP      : None
    Client-to-Client    : None
    Add path            : None
    eBGP multihop       : None
    Hop (TTL)           : None
    Any AS              : None
    Update VPNv4 NH     : None
    Update MVPN NH      : None
supervisor@rtbrick: op>
```

5.3.8. show bgp peer-group instance default

This command displays information of the BGP peer groups for the default instance.

```
supervisor@rtbrick: op> show bgp peer-group instance default
Instance: default
  Peer group name       : to_pe2
    Remote AS           : 2000
    Import rule         : None
    Export rule         : None
    Remove AS           : None
    Nexthop self        : None
    Multipath iBGP      : None
    Multipath eBGP      : None
    Client-to-Client    : None
    Add path            : None
    eBGP multihop       : None
    Hop (TTL)           : None
    Any AS              : None
    Update VPNv4 NH     : None
    Update MVPN NH      : None
```

5.3.9. show bgp peer-group <peer_group>

This command displays information of the BGP peer groups for the specified peer group on all instances.

```
supervisor@rtbrick: op> show bgp peer-group to_pe2
Instance: default
  Peer group name       : to_pe2
    Remote AS           : 2000
    Import rule         : None
    Export rule         : None
    Remove AS           : None
    Nexthop self        : None
    Multipath iBGP      : None
    Multipath eBGP      : None
    Client-to-Client    : None
    Add path            : None
    eBGP multihop       : None
    Hop (TTL)           : None
    Any AS              : None
    Update VPNv4 NH     : None
    Update MVPN NH      : None
supervisor@rtbrick: op>
```

5.3.10. show bgp peer statistics

This command displays statistics information of the BGP peer for all instances.

```
supervisor@rtbrick: op> show  bgp peer statistics
Instance: default
  Peer                            AFI     SAFI                PfxRcvd
PfxSent
  PE2                             ipv4    unicast             0          0
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             2          3
                                  ipv6    labeled-unicast     2          3
                                  ipv4    vpn-unicast         4          7
                                  ipv6    vpn-unicast         4          7
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
Instance: ip2vrf
  Peer                            AFI     SAFI                PfxRcvd
PfxSent
  CE1                             ipv4    unicast             2          2
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             0          0
                                  ipv6    labeled-unicast     0          0
                                  ipv4    vpn-unicast         0          0
                                  ipv6    vpn-unicast         0          0
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
  CE1                             ipv4    unicast             0          0
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             2          2
                                  ipv6    labeled-unicast     0          0
                                  ipv4    vpn-unicast         0          0
                                  ipv6    vpn-unicast         0          0
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
```

5.3.11. show bgp peer statistics instance default

This command displays statistics information of the BGP peer for the default instance.

```
supervisor@rtbrick: op> show bgp peer statistics instance default
Instance: default
  Peer                            AFI     SAFI                PfxRcvd
PfxSent
  PE2                             ipv4    unicast             0          0
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             2          3
                                  ipv6    labeled-unicast     2          3
                                  ipv4    vpn-unicast         4          7
                                  ipv6    vpn-unicast         4          7
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
```

5.3.12. show bgp peer statistics instance default peer <peer>

This command displays statistics information of the specified BGP peer for the default instance.

```
supervisor@rtbrick: op> show bgp peer statistics instance default peer PE2
Instance: default
  Peer                            AFI     SAFI                PfxRcvd
PfxSent
  PE2                             ipv4    unicast             0          0
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             2          3
                                  ipv6    labeled-unicast     2          3
                                  ipv4    vpn-unicast         4          7
                                  ipv6    vpn-unicast         4          7
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
supervisor@rtbrick: op>
```

5.3.13. show bgp peer statistics instance default peer address <ip_address>

This command displays statistics information of the BGP peer for the specified peer address on the default instance.

```
supervisor@rtbrick: op> show bgp peer statistics instance default peer
address 23.0.0.3
Instance: default
  Peer                            AFI     SAFI                PfxRcvd
PfxSent
  PE2                             ipv4    unicast             0          0
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             2          3
                                  ipv6    labeled-unicast     2          3
                                  ipv4    vpn-unicast         4          7
                                  ipv6    vpn-unicast         4          7
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
supervisor@rtbrick: op>
```

5.3.14. show bgp peer statistics peer <peer>

This command displays statistics information of the specified BGP peer on all instances.

```
supervisor@rtbrick: op> show bgp peer statistics peer CE1
Instance: ip2vrf
  Peer                            AFI     SAFI                PfxRcvd
PfxSent
  CE1                             ipv4    unicast             2          2
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             0          0
                                  ipv6    labeled-unicast     0          0
                                  ipv4    vpn-unicast         0          0
                                  ipv6    vpn-unicast         0          0
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
  CE1                             ipv4    unicast             0          0
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             2          2
                                  ipv6    labeled-unicast     0          0
                                  ipv4    vpn-unicast         0          0
                                  ipv6    vpn-unicast         0          0
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
```

5.3.15. show bgp peer statistics peer address <ip_address>

This command displays statistics information of the specified peer address on all instances.

```
supervisor@rtbrick: op> show bgp peer statistics peer address 12.0.0.1
Instance: ip2vrf
  Peer                            AFI     SAFI                PfxRcvd
PfxSent
  CE1                             ipv4    unicast             2          2
                                  ipv4    labeled-unicast     0          0
                                  ipv6    unicast             0          0
                                  ipv6    labeled-unicast     0          0
                                  ipv4    vpn-unicast         0          0
                                  ipv6    vpn-unicast         0          0
                                  ipv4    multicast           0          0
                                  ipv4    vpn-multicast       0          0
```

5.4. BGP Rib-in

5.4.1. show bgp rib-in

This command displays information of the received BGP routing table on all instances.

```
supervisor@rtbrick: op> show bgp rib-in
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Peer: CE1, Received routes: 2
    Prefix                              Next Hop
MED        Local Preference  AS Path
    12.0.0.0/24                         12.0.0.1                          -
100               -
    10.0.0.1/32                         12.0.0.1                          -
100               -
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    Prefix                              Next Hop
MED        Local Preference  AS Path
    34.0.0.0/24                         192::3                            0
-                 2000
    10.0.0.4/32                         192::3                            0
-                 2000
    192.0.1.3/32                        192::3                            0
-                 2000
    192.0.4.10/32                       192::3                            0
-                 2000
Instance: default, AFI: ipv6, SAFI: unicast
  Peer: PE2, Received routes: 2
    Prefix                              Next Hop
MED        Local Preference  AS Path
    192::3/128                          23.0.0.3                          0
-                 2000
    192::10/128                         23.0.0.3                          0
-                 2000
```

5.4.2. show bgp rib-in ipv4

This command displays information of the received BGP routing table for the IPv4 addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-in ipv4
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Peer: CE1, Received routes: 2
    Prefix                              Next Hop
MED        Local Preference  AS Path
    12.0.0.0/24                         12.0.0.1                            -
100               -
    10.0.0.1/32                         12.0.0.1                            -
100               -
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    Prefix                              Next Hop
MED        Local Preference  AS Path
    34.0.0.0/24                         192::3                              0
-                 2000
    10.0.0.4/32                         192::3                              0
-                 2000
    192.0.1.3/32                        192::3                              0
-                 2000
    192.0.4.10/32                       192::3                              0
-                 2000
```

5.4.3. show bgp rib-in ipv4 vpn-unicast

This command displays information of the received BGP routing table for the IPv4 vpn-unicast addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    Prefix                              Next Hop
MED        Local Preference  AS Path
    34.0.0.0/24                         192::3                              0
-                 2000
    10.0.0.4/32                         192::3                              0
-                 2000
    192.0.1.3/32                        192::3                              0
-                 2000
    192.0.4.10/32                       192::3                              0
-                 2000
```

5.4.4. show bgp rib-in ipv4 vpn-unicast detail

This command displays detailed information of the received BGP routing table for the IPv4 vpn-unicast addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast detail
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    34.0.0.0/24, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 6d:20h:49m:58s
    10.0.0.4/32, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 6d:02h:34m:21s
```

5.4.5. show bgp rib-in ipv4 vpn-unicast instance default

This command displays information of the received BGP routing table for the IPv4 vpn-unicast addresses on the default instance.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast instance default
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    Prefix                              Next Hop
MED        Local Preference  AS Path
    34.0.0.0/24                         192::3                              0
-                 2000
    10.0.0.4/32                         192::3                              0
-                 2000
    192.0.1.3/32                        192::3                              0
-                 2000
    192.0.4.10/32                       192::3                              0
-                 2000
supervisor@rtbrick: op>
```

5.4.6. show bgp rib-in ipv4 vpn-unicast instance default detail

This command displays detailed information of the received BGP routing table for the IPv4 vpn-unicast addresses on the default instance.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast instance default
detail
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    34.0.0.0/24, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 6d:20h:50m:50s
    10.0.0.4/32, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 6d:02h:35m:13s
```

5.4.7. show bgp rib-in ipv4 vpn-unicast instance default <ip_address>

This command displays information of the received BGP routing table for the specified IPv4 vpn-unicast address on the default instance.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast instance default
192.0.1.3/32
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 1
    192.0.1.3/32, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 11d:22h:26m:21s
```

5.4.8. show bgp rib-in ipv4 vpn-unicast peer address <peer_ip>

This command displays information of the received BGP routing table for the specified IPv4 vpn-unicast peer address on all the instances.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast peer address
23.0.0.3
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    Prefix                              Next Hop
MED        Local Preference  AS Path
    34.0.0.0/24                         192::3                            0
-                 2000
    10.0.0.4/32                         192::3                            0
-                 2000
    192.0.1.3/32                        192::3                            0
-                 2000
    192.0.4.10/32                       192::3                            0
-                 2000
```

5.4.9. show bgp rib-in ipv4 vpn-unicast peer address <peer_ip> detail

Displays detailed information of the received BGP routing table for the specified IPv4 vpn-unicast peer address on all the instances.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast peer address
23.0.0.3 detail
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 4
    34.0.0.0/24, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 6d:20h:53m:03s
    10.0.0.4/32, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 6d:02h:37m:26s
```

5.4.10. show bgp rib-in ipv4 vpn-unicast peer address <peer_up> <prefix>

This command displays information of the received BGP routing table for the specified IPv4 vpn-unicast peer addresses with the specified prefixes on all the

instances.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast peer address
23.0.0.3 192.0.1.3/32
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 1
    192.0.1.3/32, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 11d:22h:29m:06s
```

5.4.11. show bgp rib-in ipv4 vpn-unicast <prefix>

This command displays information of the received BGP routing table for the IPv4 vpn-unicast peer addresses with the specified prefixes on all the instances.

```
supervisor@rtbrick: op> show bgp rib-in ipv4 vpn-unicast  192.0.1.3/32
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer: PE2, Received routes: 1
    192.0.1.3/32, Received path ID: 0, Next hop: 192::3
      Protocol source: bgp, Send path ID: 766304403
      AS path: 2000
      MED: 0, Local preference: -
      Community: -
      Extended community: -
      Large community: -
      Originator ID: -
      Cluster list: -
      Last update: 11d:22h:30m:11s
```

5.4.12. show bgp rib-out

This command displays information of the sent BGP routing table on all instances.

```
supervisor@rtbrick: op> show bgp rib-out
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Peer-group: v4_pg, Sent routes: 2
    Prefix                              MED             Local Preference
Origin          Next Hop                            AS Path
    12.0.0.0/24                         -               100
Incomplete      -                                   -
    192.0.1.2/32                        -               100
Incomplete      -                                   -
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer-group: to_pe2, Sent routes: 7
    Prefix                              MED             Local Preference
Origin          Next Hop                            AS Path
    12.0.0.0/24                         0               -
Incomplete      192::2                              1000
    10.0.0.1/32                         0               -
Incomplete      192::2                              1000
    192.0.1.2/32                        0               -
Incomplete      192::2                              1000
    34.0.0.0/24                         0               -
Incomplete      192::2                              1000, 2000
    10.0.0.4/32                         0               -
Incomplete      192::2                              1000, 2000
    192.0.1.3/32                        0               -
Incomplete      192::2                              1000, 2000
    192.0.4.10/32                       0               -
Incomplete      192::2                              1000, 2000
```

5.4.13. show bgp rib-out ipv4

This command displays information of the sent BGP routing table for the IPv4 addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-out ipv4
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Peer-group: v4_pg, Sent routes: 2
    Prefix                              MED             Local Preference
Origin          Next Hop                            AS Path
    12.0.0.0/24                         -               100
Incomplete      -                                   -
    192.0.1.2/32                        -               100
Incomplete      -                                   -
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Peer-group: to_pe2, Sent routes: 7
    Prefix                              MED             Local Preference
Origin          Next Hop                            AS Path
    12.0.0.0/24                         0               -
Incomplete      192::2                              1000
    10.0.0.1/32                         0               -
Incomplete      192::2                              1000
    192.0.1.2/32                        0               -
Incomplete      192::2                              1000
    34.0.0.0/24                         0               -
Incomplete      192::2                              1000, 2000
    10.0.0.4/32                         0               -
Incomplete      192::2                              1000, 2000
    192.0.1.3/32                        0               -
Incomplete      192::2                              1000, 2000
    192.0.4.10/32                       0               -
Incomplete      192::2
```

5.4.14. show bgp rib-out ipv4 unicast

This command displays information of the sent BGP routing table for the IPv4 unicast addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-out ipv4 unicast
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Peer-group: v4_pg, Sent routes: 2
    Prefix                              MED             Local Preference
Origin          Next Hop                            AS Path
    12.0.0.0/24                         -               100
Incomplete      -                                   -
    192.0.1.2/32                        -               100
Incomplete      -                                   -
supervisor@rtbrick: op>
```

5.4.15. show bgp rib-out ipv4 unicast <prefix>

This command displays information of the sent BGP routing table for the IPv4 unicast addresses with specified prefix on all instances.

```
supervisor@rtbrick: op> show bgp rib-out ipv4 unicast 12.0.0.0/24
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Peer-group: v4_pg, Sent routes: 1
    Prefix: 12.0.0.0/24, RD: 192.0.1.2:1, Send path ID: 30752178, Next hop:
None
      Peer: -, Peer domain: -, Route source: direct, Received path ID:
12648964, Path hash: None
      AS path: None, Originator ID: None, Origin: Incomplete
      Community: None, Extended community: None
      Cluster list: None
      IGP metric: None, Local preference: 100, Multi exit discriminator: None
      Preference: 0, External route: None, Readvertised route: None
      Label: -, Route up: 12d:22h:18m:29s
```

5.4.16. show bgp rib-out ipv4 unicast detail

This command displays detailed information of the sent BGP routing table for the IPv4 unicast addresses on all instances.

```
supervisor@ixr_pe1: op> show bgp rib-out ipv4 unicast detail
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Peer-group: v4_pg, Sent routes: 2
    Prefix: 12.0.0.0/24, RD: 192.0.1.2:1, Send path ID: 30752178, Next hop:
None
      Peer: -, Peer domain: -, Route source: direct, Received path ID:
12648964, Path hash: None
      AS path: None, Originator ID: None, Origin: Incomplete
      Community: None, Extended community: None
      Cluster list: None
      IGP metric: None, Local preference: 100, Multi exit discriminator: None
      Preference: 0, External route: None, Readvertised route: None
      Label: -, Route up: 12d:22h:18m:47s
    Prefix: 192.0.1.2/32, RD: 192.0.1.2:1, Send path ID: 30752178, Next hop:
None
      Peer: -, Peer domain: -, Route source: direct, Received path ID:
12648964, Path hash: None
      AS path: None, Originator ID: None, Origin: Incomplete
      Community: None, Extended community: None
      Cluster list: None
      IGP metric: None, Local preference: 100, Multi exit discriminator: None
      Preference: 0, External route: None, Readvertised route: None
      Label: -, Route up: 12d:22h:18m:57s
```

5.5. Rib-local

5.5.1. show bgp rib-local

This command displays information of the local BGP routing table on all instances.

```
supervisor@rtbrick: op> show bgp rib-local
Instance: ip2vrf, AFI: ipv4, SAFI: unicast
  Prefix                                Peer
Next Hop                              Uptime
  12.0.0.0/24                           0.0.0.0
12d:22h:19m:29s
  12.0.0.0/24                           12.0.0.1
12.0.0.1                              6d:02h:42m:53s
  10.0.0.1/32                           12.0.0.1
12.0.0.1                              6d:02h:42m:53s
  192.0.1.2/32                          0.0.0.0
12d:22h:19m:39s
Instance: default, AFI: ipv4, SAFI: vpn-unicast
  Prefix                                Peer
Next Hop                              Uptime
  12.0.0.0/24                           0.0.0.0
12d:22h:19m:29s
  10.0.0.1/32                           0.0.0.0
6d:02h:42m:53s
  192.0.1.2/32                          0.0.0.0
12d:22h:19m:39s
  34.0.0.0/24                           23.0.0.3
192::3                                6d:20h:58m:17s
  10.0.0.4/32                           23.0.0.3
192::3                                6d:02h:42m:40s
  192.0.1.3/32                          23.0.0.3
192::3                                11d:22h:33m:20s
  192.0.4.10/32                         23.0.0.3
192::3                                11d:22h:33m:07s
```

5.5.2. show bgp rib-local ipv6

This command displays information of the local BGP routing table of the IPv6 addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-local ipv6
Instance: default, AFI: ipv6, SAFI: unicast
  Prefix                              Peer
Next Hop                            Uptime
  192::2/128                          ::
12d:22h:20m:14s
  192::3/128                          23.0.0.3
23.0.0.3                            11d:22h:33m:55s
  192::10/128                         23.0.0.3
23.0.0.3                            11d:22h:33m:42s
Instance: ip2vrf, AFI: ipv6, SAFI: unicast
  Prefix                              Peer
Next Hop                            Uptime
  12::/64                             ::
12d:22h:20m:04s
  12::/64                             12::1
12::1                               6d:02h:43m:10s
  10::1/128                           12::1
12::1                               6d:02h:43m:10s
  192:0:1::2/128                      ::
12d:22h:20m:14s
Instance: default, AFI: ipv6, SAFI: labeled-unicast
  Prefix                              Peer
Next Hop                            Uptime
  192::2/128                          ::
12d:22h:20m:14s
  192::3/128                          23.0.0.3
23.0.0.3                            11d:22h:33m:55s
  192::10/128                         23.0.0.3
23.0.0.3                            11d:22h:33m:42s
```

5.5.3. show bgp rib-local ipv6 vpn-unicast

This command displays information of the local BGP routing table of the IPv6 vpn-unicast addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-local ipv6 vpn-unicast
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix                                Peer
Next Hop                              Uptime
  12::/64                               ::
12d:22h:20m:28s
  10::1/128                             ::
6d:02h:43m:34s
  192:0:1::2/128                        ::
12d:22h:20m:38s
  34::/64                               23.0.0.3
192::3                                6d:20h:59m:16s
  10::4/128                             23.0.0.3
192::3                                6d:02h:43m:30s
  192:0:1::3/128                        23.0.0.3
192::3                                11d:22h:34m:19s
  192:0:4::10/128                       23.0.0.3
192::3                                11d:22h:34m:06s
supervisor@rtbrick: op>
```

5.5.4. show bgp rib-local ipv6 vpn-unicast <prefix>

This command displays information of the local BGP routing table of the IPv6 vpn-unicast addresses with the specified prefix on all instances.

```
supervisor@rtbrick: op> show bgp rib-local ipv6 vpn-unicast 12::/64
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix: 12::/64, Next hop:
    Next hop key: 2b38f6f1d2ae56178666d1edcffd18a85fd4509bcac9a21f
    Route source: bgp-local, Send path ID: 405188370, Received path ID:
12648964
    As path: -, Origin: Incomplete
    Multi exit discriminator: 0
    Route uptime: 12d:22h:20m:52s
```

5.5.5. show bgp rib-local ipv6 vpn-unicast detail

This command displays detailed information of the local BGP routing table of the IPv6 vpn-unicast addresses on all instances.

```
supervisor@rtbrick: op> show bgp rib-local ipv6 vpn-unicast detail
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix: 12::/64, Next hop:
    Next hop key: 2b38f6f1d2ae56178666d1edcffd18a85fd4509bcac9a21f
    Route source: bgp-local, Send path ID: 405188370, Received path ID:
12648964
    As path: -, Origin: Incomplete
    Multi exit discriminator: 0
    Route uptime: 12d:22h:21m:18s
  Prefix: 10::1/128, Next hop:
    Next hop key: 62b6c375c2ee2cb053bd5482ec1b7df18e271b6e0d37a4b0
    Route source: bgp-local, Send path ID: 2400017309, Received path ID:
    As path: -, Origin: Incomplete
    Multi exit discriminator:
    Route uptime: 6d:02h:44m:24s
  Prefix: 192:0:1::2/128, Next hop:
    Next hop key: 27b0d400bcd5a25e8806ba7a4742395c3cd55ad1306ccbd4
    Route source: bgp-local, Send path ID: 405188370, Received path ID:
12648964
    As path: -, Origin: Incomplete
    Multi exit discriminator: 0
    Route uptime: 12d:22h:21m:28s
```

5.5.6. show bgp rib-local ipv6 vpn-unicast instance default

This command displays information of the local BGP routing table of the IPv6 vpn-unicast addresses on the default instance.

```
supervisor@rtbrick: op> show bgp rib-local ipv6 vpn-unicast instance default
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix                              Peer
Next Hop                            Uptime
  12::/64                             ::
12d:22h:21m:45s
  10::1/128                           ::
6d:02h:44m:51s
  192:0:1::2/128                      ::
12d:22h:21m:55s
  34::/64                             23.0.0.3
192::3                              6d:21h:00m:33s
  10::4/128                           23.0.0.3
192::3                              6d:02h:44m:47s
  192:0:1::3/128                      23.0.0.3
192::3                              11d:22h:35m:36s
  192:0:4::10/128                     23.0.0.3
192::3                              11d:22h:35m:23s
```

5.5.7. show bgp rib-local ipv6 vpn-unicast instance default detail

This command displays detailed information of the local BGP routing table of the

IPv6 vpn-unicast addresses on the default instance.

```
supervisor@rtbrick: op> show bgp rib-local ipv6 vpn-unicast instance default
detail
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix: 12::/64, Next hop:
    Next hop key: 2b38f6f1d2ae56178666d1edcffd18a85fd4509bcac9a21f
    Route source: bgp-local, Send path ID: 405188370, Received path ID:
12648964
    As path: -, Origin: Incomplete
    Multi exit discriminator: 0
    Route uptime: 12d:22h:22m:19s
  Prefix: 10::1/128, Next hop:
    Next hop key: 62b6c375c2ee2cb053bd5482ec1b7df18e271b6e0d37a4b0
    Route source: bgp-local, Send path ID: 2400017309, Received path ID:
    As path: -, Origin: Incomplete
    Multi exit discriminator:
    Route uptime: 6d:02h:45m:25s
```

5.5.8. show bgp rib-local ipv6 vpn-unicast instance default <prefix>

This command displays information of the local BGP routing table of the IPv6 vpn-unicast addresses with the specified prefix on the default instance.

```
supervisor@rtbrick: op> show bgp rib-local ipv6 vpn-unicast instance default
34::/64
Instance: default, AFI: ipv6, SAFI: vpn-unicast
  Prefix: 34::/64, Next hop: 192::3
    Route source: bgp, Send path ID: 766304403, Received path ID: 0
    As path: 2000, Origin: Incomplete
    Multi exit discriminator: 0
    Route uptime: 6d:21h:01m:31s
```

5.6. TCP

5.6.1. show bgp tcp bgp.iod.1 connection

This command displays information of the TCP connections used by BGP for all instances.

```
supervisor@rtbrick: op> show bgp tcp bgp.iod.1 connection
Instance       Local IP Address                   Remote IP Address
Local Port  Remote Port  State
default        23.0.0.2                           23.0.0.3
179         59614        Established
ip2vrf         12.0.0.2                           12.0.0.1
179         59612        Established
ip2vrf         12::2                              12::1
58143       179          Established
```

5.6.2. show bgp tcp bgp.iod.1 connection detail

This command displays detailed information of the TCP connections used by BGP for all instances

```
supervisor@rtbrick: op> show bgp tcp bgp.iod.1 connection detail
Instance: default
  Local IPv4 address       : 23.0.0.2
  Remote IPv4 address      : 23.0.0.3
  Local port               : 179
  Remote port              : 59614
  State                    : Established
    Internal
      Options                  : -- | Keepalive | --
      TOS                      : 0
      TTL                      : 1
      Priority                 : 1
      Flags                    : -|-|-|-|-|Nagle Disabled|-|Wnd Scale|-|-|-
      Last trigger             : 139
      Timer                    : 2239640
    Timers
      Poll                     : 0s
      Poll interval            : 0s
      Retransmission           : 65535s
    Receiver
      Expected sequence        : 1900007
      Available window         : 98304
      Announced window         : 98038
      Announced wnd RT edge    : 1998045
      MSS                      : 1460
      RTT estimate             : 0
    Timeout
      Sequence                 : 1164345s
      Retransmission           : 3s
      Retransmissions          : 0s
      Duplicate acks           : 0s
      Highest ack'd sequence   : 1164364s
    Congestion
      Window                   : 16063
      Persist count            : 0
      Send scale               : 5
      Receive scale            : 5
    Sender
```

```
      Next seq to send          : 1164364
      Last wnd update seq       : 1900007
      Last wnd update ack       : 1164364
      Window                    : 97216
      Max window announced      : 98304
      Acknowledged              : None
      Send buf                  : 57344
      Send queue length         : 0
      Unsent oversize           : 0
      TS last ack sent          : 448397312
    Keepalive
      Next keepalive idle       : 7200000
      Keepalive interval        : 75000
      Keepalive count           : 9
      Keep sent count           : 0
    Authentication
      Auth type                 : None
      Send key                  : None
      Receive key1              : None
      Receive key2              : None
      Algorithm mismatch        : None
      Secret mismatch           : None
      Latest sent digest        : None
      Latest received digest    : None
```

5.6.3. show bgp tcp bgp.iod.1 connection instance default

This command displays information of the TCP connections used by BGP for the default instance.

```
supervisor@rtbrick: op> show bgp tcp bgp.iod.1 connection instance default
Instance       Local IP Address                  Remote IP Address
Local Port  Remote Port  State
default        23.0.0.2                          23.0.0.3
179         5961        Established
```

5.6.4. show bgp tcp bgp.iod.1 connection instance default detail

This command displays detailed information of the TCP connections used by BGP for the default instance

```
supervisor@rtbrick: op> show bgp tcp bgp.iod.1 connection instance default
detail
Instance: default
  Local IPv4 address       : 23.0.0.2
  Remote IPv4 address      : 23.0.0.3
  Local port               : 179
  Remote port              : 59614
  State                    : Established
    Internal
```

```
      Options                    : -- | Keepalive | --
      TOS                        : 0
      TTL                        : 1
      Priority                   : 1
      Flags                      : -|-|-|-|-|Nagle Disabled|-|Wnd Scale|-|-|-
      Last trigger               : 139
      Timer                      : 2239640
    Timers
      Poll                       : 0s
      Poll interval              : 0s
      Retransmission             : 65535s
    Receiver
      Expected sequence          : 1900007
      Available window           : 98304
      Announced window           : 98038
      Announced wnd RT edge      : 1998045
      MSS                        : 1460
      RTT estimate               : 0
    Timeout
      Sequence                   : 1164345s
      Retransmission             : 3s
      Retransmissions            : 0s
      Duplicate acks             : 0s
      Highest ack'd sequence     : 1164364s
    Congestion
      Window                     : 16063
      Persist count              : 0
      Send scale                 : 5
      Receive scale              : 5
    Sender
      Next seq to send           : 1164364
      Last wnd update seq        : 1900007
      Last wnd update ack        : 1164364
      Window                     : 97216
      Max window announced       : 98304
      Acknowledged               : None
      Send buf                   : 57344
      Send queue length          : 0
      Unsent oversize            : 0
      TS last ack sent           : 448397312
    Keepalive
      Next keepalive idle        : 7200000
      Keepalive interval         : 75000
      Keepalive count            : 9
      Keep sent count            : 0
    Authentication
      Auth type                  : None
      Send key                   : None
      Receive key1               : None
      Receive key2               : None
      Algorithm mismatch         : None
      Secret mismatch            : None
      Latest sent digest         : None
      Latest received digest     : None
```

5.6.5. show bgp tcp bgp.iod.1 statistics

This command displays TCP statistics information of the TCP connections used by BGP for all instances.

```
supervisor@rtbrick: op> show bgp tcp bgp.iod.1 statistics
Instance: default
  IP statistics
    Transmitted packets    : 3103242412
    Received packets       : 47351
    Forwarded packets      : 0
    Dropped packets        : 0
    Checksum error         : 0
    Invalid length error   : 0
    Out of memory error    : 0
    Routing error          : 0
    Protocol error         : 0
    Error in options       : 0
    Misc error             : 0
    Cachehit               : 0
  TCP statistics
    Transmitted packets    : 365499779
    Received packets       : 5577
    Forwarded packets      : 3014656
    Dropped packets        : 46
    Checksum error         : 0
    Invalid length error   : 0
    Out of memory error    : 0
    Routing error          : 3014656
    Protocol error         : 46
    Error in options       : 0
    Misc error             : 2097152
    Cachehit               : 1557594144
Instance: ip2vrf
  IP statistics
    Transmitted packets    : 3103242412
    Received packets       : 47351
    Forwarded packets      : 0
    Dropped packets        : 0
    Checksum error         : 0
    Invalid length error   : 0
    Out of memory error    : 0
    Routing error          : 0
    Protocol error         : 0
    Error in options       : 0
    Misc error             : 0
    Cachehit               : 0
  TCP statistics
    Transmitted packets    : 365499779
    Received packets       : 5577
    Forwarded packets      : 3014656
    Dropped packets        : 46
    Checksum error         : 0
    Invalid length error   : 0
    Out of memory error    : 0
    Routing error          : 3014656
    Protocol error         : 46
    Error in options       : 0
    Misc error             : 2097152
    Cachehit               : 1557594144
```

5.6.6. show bgp tcp bgp.iod.1 statistics instance <instance>

This command displays TCP statistics information of the TCP connections used by BGP for the specified instance.

```
supervisor@rtbrick: op> show bgp tcp bgp.iod.1 statistics  instance ip2vrf
Instance: ip2vrf
  IP statistics
    Transmitted packets    : 3103242412
    Received packets       : 47351
    Forwarded packets      : 0
    Dropped packets        : 0
    Checksum error         : 0
    Invalid length error   : 0
    Out of memory error    : 0
    Routing error          : 0
    Protocol error         : 0
    Error in options       : 0
    Misc error             : 0
    Cachehit               : 0
  TCP statistics
    Transmitted packets    : 365499779
    Received packets       : 5577
    Forwarded packets      : 3014656
    Dropped packets        : 46
    Checksum error         : 0
    Invalid length error   : 0
    Out of memory error    : 0
    Routing error          : 3014656
    Protocol error         : 46
    Error in options       : 0
    Misc error             : 2097152
    Cachehit               : 1557594144
```

6. BGP Clear Commands

6.1. clear bgp peer all

This command clears all the BGP peers.

```
supervisor@rtbrick: op> clear bgp peer all
```

6.2. clear bgp peer all soft-in <afi> <safi>

This command sends route refresh to all neighbors.

```
supervisor@rtbrick: op> clear bgp peer all soft-in ipv4 unicast
```

6.3. clear bgp peer all soft-out <afi> <safi>

This command re-advertises all the routes previously sent to the peer.

```
supervisor@rtbrick: op> clear bgp peer all soft-out ipv4 unicast
```

6.4. clear bgp peer all stats

This command clears the statistics of all the BGP peers.

```
supervisor@rtbrick: op> clear bgp peer all stats
```

6.5. clear bgp peer instance <instance> <peer-ip>

This command clears the peer for the given instance and peer-ip.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1
```

6.6. clear bgp peer instance <instance> <peer-ip> source <src-ip>

This command clears a specific peer for the given peer-ip and source-ip in the specified instance.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1 source
12.0.0.2
```

6.7. clear bgp peer instance <instance> all

This command clears all peers in the given instance.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf all
```

6.8. clear bgp peer instance <instance> <peer-ip> source <src-ip> soft-in <afi> <safi>

This command sends route refresh to specific peer for the given instance, peer-ip, source-ip and address-family.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1 source
12.0.0.2 soft-in ipv4 unicast
```

6.9. clear bgp peer instance <instance> <peer-ip> soft-in <afi> <safi>

This command sends route refresh to peer for the given instance, peer-ip and address-family.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1 soft-in ipv4
unicast
```

6.10. clear bgp peer instance <instance> all soft-in <afi> <safi>

This command sends route refresh to all peers for the given instance and address-family.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf all soft-in ipv4
unicast
```

6.11. clear bgp peer instance <instance> <peer-ip> source <src-ip> soft-out <afi> <safi>

This command re-advertises all the routes previously sent to the specific peer for the given instance, peer-ip, source-ip and address-family.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1 source
12.0.0.2 soft-out ipv4 unicast
```

6.12. clear bgp peer instance <instance> <peer-ip> soft-out <afi> <safi>

This command sends route refresh to peer for given instance, peer-ip and address-family.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1 soft-out ipv4
unicast
```

6.13. clear bgp peer instance <instance> all soft-out <afi> <safi>

This command sends route update to all peers for given instance and address-family.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf all soft-out ipv4
unicast
```

6.14. clear bgp peer instance <instance> <peer-ip> source <src-ip> stats

This command clears the statistics of a specific peer for given instance, peer-ip and source-ip.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1 source
12.0.0.2 stats
```

6.15. clear bgp peer instance <instance> <peer-ip> stats

This command clears the statistics of the peer for given instance and peer-ip.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf 12.0.0.1 stats
```

6.16. clear bgp peer instance <instance> all stats

This command clears the statistics of all peers for given instance.

```
supervisor@rtbrick: op> clear bgp peer instance ip2vrf all stats
```

7. Routing Policies and Examples

This section covers the RtBrick way of configuring routing polices.

7.1. The Role of Routing Policy

Routing Policies are the rules that allows you to control and modify the default behaviour of the routing protocols such as BGP and IS-IS. To use routing policies, you configure policies, and then apply policies to peer groups or instances.

RtBrick supports attaching a BGP routing policy at two levels:

- Peer group address-family level
- Instance address-family level

In each case, you can apply the policy as an import or export policy and filter. As expected, import filters determine which routing updates are accepted and export filters determine which routes are advertised to other peers.

7.2. Peer Group and Instance Details

An import policy, when applied to an address family at the peer group level, examines all *incoming* routes from all BGP peers in the peer group, but only for that address family.

An export policy, when applied to an address family at the peer group level, examines all outgoing routes to all BGP peers in the peer group. but only for that address family.

At the instance level, routing policies that are applied to an address family can work as import or export policies, but for the instance as a whole.

An import policy, when applied to an address family at the instance level, examines all incoming routes before accepting the information only from global or default tables to other instance or VRF table.

An export policy, when applied to an address family at the instance level, examines all outgoing routes before sending the information from the VRF to global, and then to the vpn table (default).

7.3. Attachment Point

Policies are useful when they are applied to routes, and for policies to be applied to routes they need to be made known to routing protocols. In BGP, for example, there are several situations where policies can be used, the most common of these is defining import and export policy. The policy attachment point is the point in

which an association is formed between a specific protocol entity, in this case a BGP neighbor, and a specific named policy.

Attachment Point for Export Policy to peer-group

Export policies attached to a BGP peer-group, can be used to apply certain conditions based on any of the route attributes and advertise to the peers, only those route that match our criteria.

```
set instance ip2vrf protocol bgp peer-group leaf1 address-family ipv4 vpn-
unicast policy policy-name p2 export
```

Input

```
rtb bgp.appd.1 show datastore table dump default.bgp.routing-table.ipv4.vpn-
unicast
```

Output

```
rtb bgp.appd.1 show datastore table dump default.bgp.1.peer-
group.leaf1.ipv4.vpn-unicast
```

Attachment Point for Import Policy to peer-group

Import policies attached to a BGP peer-group, can be used to filter and modify based on any of the route attribute that we wish to.

```
set instance ip2vrf protocol bgp peer-group rr address-family ipv4 unicast
policy <POLICY-NAME> import
```

Input

```
rtb bgp.appd.1 show datastore table dump default.bgp.rib-
in.ipv4.unicast.<peer_ip>.<local_ip>
```

Attachment Point for Export Policy to main Instance

Export policies attached to an instance, help us to modify the attributes of a route present in the instance before exporting them as VPN routes. If we would to attach an extended_community, nexthop, community etc before exporting them as VPN routes, we can do so by using this attachment point.

```
set instance ip2vrf address-family ipv4 unicast policy policy-name p1 export
```

Input

```
rtb bgp.appd.1 show datastore table dump ip2vrf.bgp.1.fib-local.ipv4.unicast
rtb bgp.appd.1 show datastore table dump ip2vrf.bgp.rib-
in.ipv4.unicast.0.0.0.0
```

Output

```
rtb bgp.appd.1 show datastore table dump default.bgp.rib-local.ipv4.vpn-
unicast
```

Attachment Point for import policy to main instance

Import policies attached to an instance, help us to modify the attributes of a route/route-list before importing into the instance. The matching criteria can be any of the route attributes such as prefix, as_path, community, extended_community etc.

```
set instance ip2vrf address-family ipv4 unicast policy policy-name p1 import
```

Input

```
rtb bgp.appd.1 show datastore table dump default.bgp.fib-local.ipv4.vpn-
unicast
```

Output

```
rtb bgp.appd.1 show datastore table dump ip2vrf.bgp.1.rib-local.ipv4.unicast
```

7.4. Routing Policy Examples

The following sections show a few examples of useful routing policies for BGP.

7.4.1. Apply Import Policy to peer group

```
set policy-options policy-statement
SPINE_BLOCK_IPv4_AGGR_ROUTE_WITH_COMMUNITY term MATCH_COMMUNITY ordinal 1
match-conditions match-type or rules rule 1 route community match exact value
200:10
set policy-options policy-statement
SPINE_BLOCK_IPv4_AGGR_ROUTE_WITH_COMMUNITY term MATCH_COMMUNITY ordinal 1
action rules rule 1 action return-deny
set policy-options policy-statement
SPINE_BLOCK_IPv4_AGGR_ROUTE_WITH_COMMUNITY term ADD_COMMUNITY ordinal 5
action rules rule 1 route community operation overwrite value 800:80
set policy-options policy-statement
SPINE_BLOCK_IPv4_AGGR_ROUTE_WITH_COMMUNITY term ADD_COMMUNITY ordinal 5
action rules rule 2 action return-permit
set instance ip2vrf protocol bgp peer-group rr address-family ipv4 unicast
policy policy-name SPINE_BLOCK_IPv4_AGGR_ROUTE_WITH_COMMUNITY import
```

7.4.2. Apply export policy to peer group

```
set policy-options policy-statement BLOCK_VPN_INTERNET_ROUTES term
MATCH_COMMUNITY ordinal 1 match-conditions match-type or rules rule 1 route
community match exact value 800:80
set policy-options policy-statement BLOCK_VPN_INTERNET_ROUTES term
MATCH_COMMUNITY ordinal 1 action rules rule 1 action return-deny
set policy-options policy-statement BLOCK_VPN_INTERNET_ROUTES term
PERMIT_OTHERWISE ordinal 10 action rules rule 1 action return-permit
set instance protocol bgp peer-group leaf1 address-family ipv4 vpn-unicast
policy policy-name BLOCK_VPN_INTERNET_ROUTES export
```

7.4.3. Apply policy to main instance

7.4.3.1. Export Policy

```
set policy-options policy-statement V4_STATIC_ROUTE_APPLY_COMMUNITY term
MATCH_SOURCE ordinal 1 match-conditions match-type or rules rule 1 route
source match exact value static
set policy-options policy-statement V4_STATIC_ROUTE_APPLY_COMMUNITY term
MATCH_SOURCE ordinal 1 action rules rule 1 route community operation
overwrite value 300:10
set policy-options policy-statement V4_STATIC_ROUTE_APPLY_COMMUNITY term
PERMIT_OTHERWISE ordinal 2 action rules rule 1 action return-permit
set instance ip2vrf address-family ipv4 unicast policy policy-name
V4_STATIC_ROUTE_APPLY_COMMUNITY export
```

7.4.3.2. Import Policy

```
set policy-options policy-statement BLOCK_AGGR_ROUTE_LEAF_V4 term
MATCH_COMMUNITY ordinal 1 match-conditions match-type or rules rule 1 route
community match exact value 100:10
set policy-options policy-statement BLOCK_AGGR_ROUTE_LEAF_V4 term
MATCH_COMMUNITY ordinal 1 action rules rule 1 action return-deny
set policy-options policy-statement BLOCK_AGGR_ROUTE_LEAF_V4 term
PERMIT_OTHERWISE ordinal 2 action rules rule 1 action return-permit
set instance ip2vrf address-family ipv4 unicast policy policy-name
BLOCK_AGGR_ROUTE_LEAF_V4 import
```

Note:There is no need to specify the protocol when the policy applies to other than the main instance.

7.4.4. Apply policy to VRF instance and Address Family

```
set policy-options policy-statement V4_STATIC_ROUTE_APPLY_COMMUNITY term
MATCH_SOURCE ordinal 1 match-conditions match-type or rules rule 1 route
source match exact value static
set policy-options policy-statement V4_STATIC_ROUTE_APPLY_COMMUNITY term
MATCH_SOURCE ordinal 1 action rules rule 1 route community operation
overwrite value 300:10
set policy-options policy-statement V4_STATIC_ROUTE_APPLY_COMMUNITY term
PERMIT_OTHERWISE ordinal 2 action rules rule 1 action return-permit
set instance ip2vrf address-family ipv4 unicast policy policy-name
V4_STATIC_ROUTE_APPLY_COMMUNITY export
```

7.5. Routing Policy Summary

These examples show only the basics of the complete application of routing policy. Almost all BGP attributes can be used, along with many possible keywords. The current list is as follows:

- as-path
- bgp-nh4
- bgp-nh6
- cluster-list
- community
- extended-community
- label
- large-community
- local-preference
- med
- origin

- originator-id
- peer4
- peer6
- prefix4
- prefix6
- rd
- router-id4
- src-ipv4-address
- src-ipv6-address

8. BGP MD5-Authentication Configuration Commands

Border Gateway Protocol (BGP) supports the authentication mechanism using the Message Digest 5 (MD5) algorithm. When authentication is enabled, any Transmission Control Protocol (TCP) segment belonging to BGP exchanged between the peers is verified and accepted only if authentication is successful. For authentication to be successful, both the peers must be configured with the same password. If authentication fails, the BGP neighbor relationship is not be established.

8.1. Commands for enabling MD5 authentication for BGP IPv4 session

- Remove 'ip2vrf' from the commands if you want to configure MD5-authentication under default instance.
- When one of the parameters such as source-port, destination-port, source-ip or destination-ip is matched, the authentication will be successful

8.1.1. Setting authentication type

The following command sets the MD5 authentication type.

Syntax

set instance <instance> **tcp authentication-identifier rtb_spine_1 authentication-type MD5**

Example

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 authentication-type MD5
root@rtbrick: cfg> commit
```

8.1.2. Setting source port

The following command sets the source port.

Syntax

set instance <instance> **tcp authentication-identifier rtb_spine_1 source-port** <port-number>

Command arguments

<port-number>	Specify port number range 0-65535

Example

If the default value 0 is used as a port-number, then match is done for any of the source-port

```
root@spine1:confd> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 source-port 0
```

8.1.3. Setting destination port

The following command sets the destination port.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **destination-port** <port-number>

Command arguments

<identifier>	Name of the tcp authentication identifier
<port-number>	Specify port number range 0-65535

Example

If the default value 0 is used as a port-number, then match is done for any of the destination-port

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 destination-port 0
root@rtbrick: cfg> commit
```

8.1.4. Setting destination prefix

The following command sets the destination prefix address.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **destination-**

prefix ipv4 <ipv4_address>

Command arguments

<identifier>	Name of the tcp authentication identifier
<ipv4_address>	Specify a valid IPv4 address, for example 10.10.10.2/24

Example

With IP as 0.0.0.0/0, will match any destination-prefix

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 destination-prefix ipv4 10.10.10.1/32
root@rtbrick: cfg> commit
```

8.1.5. Setting source prefix

The following command sets the source prefix address.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **source-prefix ipv4** <ipv4_address>

Command arguments

<identifier>	Name of the tcp authentication identifier
<ipv4_address>	Specify a valid source-prefix IPv4 address, for example 10.10.10.2/24

Example

with IP as 0.0.0.0/0, will match any source-prefix

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 source-prefix ipv4 99.99.99.9/32
root@rtbrick: cfg> commit
```

8.1.6. Setting receive id

The following command sets the receiver key identifier.

Syntax

set instance <instance> **tcp authentication-identifier** rtb_spine_1* <receive-key-id> <key-id> <receive-key> <authentication-key>

Command arguments

<instance>	Name of the BGP instance
<receive-key-id>	The receiver-key-id, for example " receive-key1-id, receive-key2-id"
<key-id>	Key-id, for example "key_id as 1 for receive-key1-id or key_id as 2 for receive-key2-id"
<receive-key>	receive-key, for example "receive-key1 for receive-key1-id or receive-key2 for receive-key2-id"
<authentication-key>	MD5 authentication-key

Example

Passwords need to be mandatorily prefixed with a zero for MD5

For receive-key1-id

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 receive-key1-id 1 receive-key1 0MD5
root@rtbrick: cfg> commit
```

For receive-key2-id

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 receive-key2-id 2 receive-key2 0MD5
root@rtbrick: cfg> commit
```

8.1.7. Setting send id

The following command sets the sender's key identifier.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **send-key-id** <key-id> **send-key** <authentication-key>

Command arguments

<instance>	Name of the BGP instance
<identifier>	Name of the TCP authentication identifier
<key-id>	Key-id
<authentication-key>	MD5 authentication-key

Example

Passwords need to be mandatorily prefixed with a zero for MD5

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 send-key-id 1 send-key 0MD5
root@rtbrick: cfg> commit
```

8.2. Commands for enabling MD5 authentication for a link-local IPv6 peer

Note: When one of the parameters such as source-port, destination-port, source-ip or destination-ip is matched, the authentication will be successful

8.2.1. Setting authentication type

The following command sets the MD5 authentication type.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **authentication-type MD5**

Example

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 authentication-type MD5
root@rtbrick: cfg> commit
```

8.2.2. Setting source port

The following command sets the source port.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **source-port** <port-number>

Command arguments

<instance>	Name of the BGP instance
<identifier>	Name of the TCP authentication identifier
<port-number>	Specify port number range 0-65535

Example

If the default value 0 is used as a port-number, then match is done for any of the source-port

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 source-port 0
root@rtbrick: cfg> commit
```

8.2.3. Setting destination port

The following command sets the destination port.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **destination-port** <port-number>

Command arguments

<instance>	Name of the BGP instance
<identifier>	Name of the TCP authentication identifier
<port-number>	Specify port number range 0-65535

Example

If the default value 0 is used as a port-number, then match is done for any of the destination-port

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 destination-port 0
root@rtbrick: cfg> commit
```

8.2.4. Setting destination prefix

The following command sets the destination prefix address.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> **destination-prefix ipv6** <ipv6_address>

Command arguments

<instance>	Name of the BGP instance
<identifier>	Name of the TCP authentication identifier
<ipv6_address>	Specify a valid IPv6 address, for example fe80::780b:9ff:fe67:1/128

Example

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 destination-prefix ipv6 fe80::780b:9ff:fe67:1/128
root@rtbrick: cfg> commit
```

8.2.5. Setting source prefix

The following command sets the source prefix address.

Syntax

< **set instance** <instance> **tcp authentication-identifier** <identifier> **source-prefix ipv6** <ipv6_address>

Command arguments

<instance>	Name of the BGP instance

<identifier>	Name of the TCP authentication identifier
<ipv6_address>	Specify a valid source-prefix IPv6 address, for example fe80::7871:b4ff:fe93:2/128

Example

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 source-prefix ipv6 fe80::7871:b4ff:fe93:2/128
root@rtbrick: cfg> commit
```

8.2.6. Setting receive id

The following command sets the receiver key identifier.

Syntax

set instance <instance> **tcp authentication-identifier** <identifier> <receive-key-id> <key-id> <receive-key> <authentication-key>

Command arguments

<instance>	Name of the BGP instance
<identifier>	Name of the TCP authentication identifier
<receive-key-id>	The receiver-key-id, for example " receive-key1-id, receive-key2-id"
<key-id>	Key-id, for example "key_id as 1 for receive-key1-id or key_id as 2 for receive-key2-id"
<receive-key>	receive-key, for example "receive-key1 for receive-key1-id or receive-key2 for receive-key2-id"
<authentication-key>	MD5 authentication-key

Example

Passwords need to be mandatorily prefixed with a zero for MD5

For receive-key1-id

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 receive-key1-id 1 receive-key1 0MD5
root@rtbrick: cfg> commit
```

For receive-key2-id

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 receive-key2-id 2 receive-key2 0MD5
root@rtbrick: cfg> commit
```

8.2.7. Setting send id

The following command sets the sender's key identifier.

Syntax

set instance <instance> **tcp authentication-identifier** <idenifier> **send-key-id** <key-id> **send-key** <authentication-key>

Command arguments

<instance>	Name of the BGP instance
<identifier>	Name of the TCP authentication identifier
<key-id>	Key-id
<authentication-key>	MD5 authentication-key

Example

Passwords need to be mandatorily prefixed with a zero for MD5

```
root@rtbrick: cfg> set instance ip2vrf tcp authentication-identifier
rtb_spine_1 send-key-id 1 send-key 0MD5
root@rtbrick: cfg> commit
```

9. Configuring IPv6 Provider Edge over MPLS (6PE)

6PE solution enables IPv6 communication over MPLS IPv4 core network. IPv6 reachability information is associated with a label and transferred through MP-BGP(AFI: 2 SAFI:4). IPv4 mapped IPv6 address is used to encode the nexthop information. The edge nodes in MPLS IPv4 core have to support both IPv4 and IPv6. The IPv6 Labeled Unicast routes received from the 6PE peer is considered as IPv6 unicast routes and installed in IPv6 Unicast FIB. The received Label is attached to the IPv6 data traffic at the Ingress node and tunneled through a MPLS tunnel(SR) to the egress node, the label identifies the IPv6 traffic and the egress node would POP the label and forward the ipv6 traffic towards the destination.

9.1. Enabling 6PE for a BGP Address-family

9.1.1. Enable ipv6 unicast for BGP instance

The following command enables IPv6 unicast address-family under BGP instance.

Syntax

set instance <instance> **protocol bgp address-family ipv6 unicast**

Example

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv6
unicast
root@rtbrick: cfg> commit
```

9.1.2. Enable ipv6 labeled-unicast for BGP instance

The following command enables IPv6 labeled-unicast address-family under BGP instance.

Syntax

set instance <instance> **protocol bgp address-family ipv6 labeled-unicast**

Example

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv6
labeled-unicast
root@rtbrick: cfg> commit
```

9.1.3. Setting lookup SAFI for IPv6 unicast prefixes

The following command resolves the nexthop address associated with the 6PE route on IPv4 labeled-unicast as nexthop for 6PE route is IPv4 mapped IPv6 address..

Syntax

set instance <instance> **protocol bgp address-family ipv6 unicast resolve nexthop safi labeled-unicast**

Example

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp address-family ipv6
unicast resolve nexthop safi labeled-unicast
root@rtbrick: cfg> commit
```

9.1.4. Enable IPv6 labeled-unicast AFI/SAFI under peer-group

The following command enables IPv6 labeled-unicast address-family under peer-group to which iBGP peer is attached.

Syntax

set instance <instance> **protocol bgp peer-group** <peer-group-name> **address-family ipv6 labeled-unicast**

Example

```
root@rtbrick: cfg> set instance ip2vrf protocol bgp peer-group leaf1 address-
family ipv6 labeled-unicast
root@rtbrick: cfg> commit
```

9.1.5. Setting send-label for IPv6 unicast AFI/SAFI

The following command enables advertisement of the label along with the IPv6 unicast route through iBGP session.

Syntax

set instance <instance> **protocol bgp peer-group** <peer-group-name> **address-family ipv6 unicast send-label**

Example

```
root@rtbrick: cfg> root@spine1:confd> set instance ip2vrf protocol bgp peer-
group leaf1 address-family ipv6 unicast send-label
root@rtbrick: cfg> commit
```