Configuring BGP Monitoring Protocol

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Prerequisites for BGP Monitoring Protocol

Before you configure BGP Monitoring Protocol (BMP) servers, you must configure Border Gateway Protocol (BGP) neighbors, which function as BMP clients, and establish a session with its peers using either IPv4/IPv6 or VPNv4/VPNv6 address-family identifiers.

Information About BGP Monitoring Protocol

The BGP Monitoring Protocol (BMP) feature enables monitoring of BGP neighbors (called BMP clients). You can configure a device to function as a BMP server, which monitors either one or several BMP clients, which in turn, has several active peer sessions configured. You can also configure a BMP client to connect to one or more BMP servers. The BMP feature enables configuration of multiple BMP servers (configured as primary servers) to function actively and independent of each other, simultaneously to monitor BMP clients.

Each BMP server is specified by a number and you can use command-line interface (CLI) to configure parameters such as IP address, port number, and so on. Upon activation of a BMP server, it attempts to connect to BMP clients by sending an initiation message. The CLI enables multiple—independent and asynchronous—BMP server connections.

BGP neighbors, called BMP clients, are configured to send data to specific BMP servers for monitoring purposes. These clients are configured in a queue. When a request for a connection arrives from BMP clients to BMP servers, the connection is established based on the order in which the requests arrived. Once the BMP server connects with the first BMP neighbor, it sends out refresh requests to monitor the BMP clients and starts monitoring those BMP clients with whom the connection is already established.

The session connection requests from the other BMP clients in queue to the BMP servers initiates after an initial delay that you can configure using the **initial-delay** command. If a connection establishes but fails later, due to some reason, the connection request is retried after a delay, which you can configure using **failure-retry-delay** command. If there is repeated failure in connection establishment, the connection retries are delayed based on the delay that is configured using the **flapping-delay** command. Configuring the delay for such requests becomes significant because the routes refresh requests that are sent to all connected BMP clients causes considerable network traffic and load on the device.

To avoid excessive load on the device, the BMP servers send route refresh requests to individual BMP clients at a time, in the order in which connections are established in the queue. Once a BMP client that is already connected is in the "reporting" state, it sends a "peer-up" message to the BMP server. After the client receives a route-refresh request, route monitoring begins for that neighbor. Once the route refresh request ends, the next neighbor in the queue is processed. This cycle continues until all "reporting" BGP neighbors are reported and all routes that are sent by these "reporting" BGP neighbors are continuously monitored. If a neighbor establishes after BMP monitoring has begun, it does not require a route-refresh request. All received routes from that client are sent to BMP servers.

It is advantageous to batch up refresh requests from BMP clients, if several BMP servers are activated in quick succession. Use the **bmp initial-refresh delay** command to configure a delay in triggering the refresh mechanism when the first BMP server comes up. If other BMP servers come online within this time-frame, only one set of refresh requests is sent to the BMP clients. You can also configure the **bmp initial-refresh skip** command to skip all refresh requests from BMP servers and just monitor all incoming messages from the peers.

In a client-server configuration, it is recommended that the resource load of the devices be kept minimal and adding excessive network traffic must be avoided. In the BMP configuration, you can configure various delay timers on the BMP server to avoid flapping during connection between the server and client. To avoid excessive message throughput or high usage of system resources, you can configure the maximum buffer limit for the BMP session.

How to Configure BGP Monitoring Protocol

The following sections provide configurational information about BGP monitoring protocol.

Configuring a BGP Monitoring Protocol Session

Perform this task to configure BGP Monitoring Protocol (BMP) session parameters for the BMP servers to establish connectivity with BMP clients.

To configure a BGP monitoring protocol session, perform this procedure:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *as-number* **Example:** `Device(config)# router bgp 65000`	Enters router configuration mode and creates a BGP routing process.
Step 4	**bmp** {**buffer-size** *buffer-bytes* | **initial-refresh** {**delay** *refresh-delay* | **skip**} | **server** *server-number-n* **Example:** `Device(config-router)# bmp initial-refresh delay 30`	Configures BMP parameters for BGP neighbors and enters BMP server configuration mode to configure BMP servers.
Step 5	**end** **Example:** `Device(config-router)# end`	Returns to privileged EXEC mode.

Configuring BGP Monitoring Protocol on BGP Neighbors

Perform this task to activate BGP Monitoring Protocol (BMP) on BGP neighbors (also called BMP clients) so that the client activity is monitored by the BMP server that is configured on the neighbor.

To configure BGP monitoring protocol on BGP neighbors, perform this procedure:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *as-number* **Example:**	Enters router configuration mode and creates a BGP routing process.

	Command or Action	Purpose
	`Device(config)# router bgp 65000`	
Step 4	**neighbor** {*ipv4-addr* | *neighbor-tag* | *ipv6-addr*} **bmp-activate** {**all** | **server** *server-number-1* [**server** *server-number-2* . . . [**server** *server-number-n*]]} **Example:** `Device(config-router)# neighbor 30.1.1.1 bmp-activate server 1 server 2`	Activates BMP monitoring on a BGP neighbor.
Step 5	Repeat Steps 1 to 4 to configure other BMP clients in the session.	
Step 6	**end** **Example:** `Device(config-router)# end`	Returns to privileged EXEC mode.

Configuring BGP Monitoring Protocol Servers

Perform this task to configure BGP Monitoring Protocol (BMP) servers and its parameters in BMP server configuration mode.

To configure BGP monitoring protocol servers, perform this procedure:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *as-number* **Example:** `Device(config)# router bgp 65000`	Enters router configuration mode and creates a BGP routing process.
Step 4	**bmp** {**buffer-size** *buffer-bytes* | **initial-refresh** {**delay** *refresh-delay* | **skip**} | **server** *server-number-n*	Enters BMP server configuration mode to configure BMP servers.

	Command or Action	Purpose
	Example: `Device(config-router)# bmp server 1`	
Step 5	**activate** **Example:** `Device(config-router-bmpsrvr)# activate`	Initiates a connection between BMP server and BGP neighbors.
Step 6	**address** {*ipv4-addr* | *ipv6-addr*} **port-number** *port-number* **Example:** `Device(config-router-bmpsrvr)# address 10.1.1.1 port-number 8000`	Configures IP address and port number to a specific BMP server.
Step 7	**description LINE** *server-description* **Example:** `Device(config-router-bmpsrvr)# description LINE SERVER1`	Configures a textual description of a BMP server.
Step 8	**failure-retry-delay** *failure-retry-delay* **Example:** `Device(config-router-bmpsrvr)# failure-retry-delay 40`	Configures delay in the retry requests during failures when sending BMP server updates.
Step 9	**flapping-delay** *flap-delay* **Example:** `Device(config-router-bmpsrvr)# flapping-delay 120`	Configures delays in flapping when sending BMP server updates.
Step 10	**initial-delay** *initial-delay-time* **Example:** `Device(config-router-bmpsrvr)# initial-delay 20`	Configures delays in sending initial requests for updates from the BMP servers.
Step 11	**set ip dscp** *dscp-value* **Example:** `Device(config-router-bmpsrvr)# set ip dscp 5`	Configures the IP Differentiated Services Code Point (DSCP) values for BMP servers.

	Command or Action	Purpose
Step 12	**stats-reporting-period** *report-period* **Example:** `Device(config-router-bmpsrvr)# stats-reporting-period 30`	Configures the time interval in which the BMP server receives the statistics report from BGP neighbors.
Step 13	**update-source** *interface-type interface-number* **Example:** `Device(config-router-bmpsrvr)# update-source ethernet 0/0`	Configures the interface source for routing updates on the BMP servers.
Step 14	**exit-bmp-server-mode** **Example:** `Device(config-router-bmpsrvr)# exit-bmp-server-mode`	Exits from BMP server configuration mode and returns to router configuration mode.
Step 15	Repeat Steps 1 to 14 to configure other BMP servers in the session.	
Step 16	**end** **Example:** `Device(config-router)# end`	Returns to privileged EXEC mode.

Configuring BGP Monitoring Protocol on VRF Neighbors

Perform this task to activate BGP Monitoring Protocol (BMP) on VRF neighbors.

To configure BGP monitoring protocol on VRF neighbors, perform this procedure:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**router bgp** *as-number* **Example:** `Device(config)# router bgp 65000`	Enters router configuration mode and creates a BGP routing process.
Step 4	**address-family** {**ipv4** | **ipv6**} **vrf** *vrf-name* **Example:** `Device (config-router)# address-family 10.1.1.1 vrf vrf1`	Enters address family configuration mode and specifies the name of the VPN routing and forwarding (VRF) instance to associate with address family configuration mode commands.
Step 5	**neighbor** {*ipv4-addr* | *neighbor-tag* | *ipv6-addr*} **bmp-activate** {**all** | **server** *server-number-1* [**server** *server-number-2* . . . [**server** *server-number-n*]]} **Example:** `Device(config-router)# neighbor 10.1.1.1 bmp-activate server 1 server 2`	Activates BMP monitoring on a VRF neighbor.
Step 6	Repeat Steps 1 to 5 to configure other VRF neighbors in the session.	
Step 7	**end** **Example:** `Device(config-router)# end`	Returns to privileged EXEC mode.

Verifying BGP Monitoring Protocol

Perform the following steps to verify the configuration for the BGP Monitoring Protocol (BMP) servers and BMP clients:

To verify BGP monitoring protocol, perform this procedure:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**show ip bgp bmp** **Example:**	Displays information about BMP servers and neighbors.

	Command or Action	Purpose
	`Device# show ip bgp bmp neighbors`	
Step 3	**show running-config** **Example:** `Device# show running-config | section bmp`	Displays information about BMP servers and neighbors.

Monitoring BGP Monitoring Protocol

Perform the following steps to enable debugging and monitor the BGP Monitoring Protocol (BMP) servers.

To monitor BGP monitoring protocol, perform this procedure:

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**debug ip bgp bmp** **Example:** `Device# debug ip bgp bmp server`	Enables debugging of the BMP attributes.
Step 3	**show debugging** **Example:** `Device# show debugging`	Displays information about the types of debugging that are enabled on a device.

Examples for Configuring, Verifying, and Monitoring BGP Monitoring Protocol

Examples: Configuring BGP Monitoring Protocol

Note There are two levels of configuration required for the BGP Monitoring Protocol (BMP) to function as designed. You must enable BMP monitoring on each BGP neighbor (also called BMP client) to which several peers are connected in a network, and establish connectivity between the BMP servers and clients. Then, configure each BMP server in BMP server configuration mode for a specific server with the parameters required for monitoring the associated BMP clients.

The following example shows how to activate BMP on a neighbor with IP address 30.1.1.1, which is monitored by BMP servers (in this case, server 1 and 2):

```
Device> enable
Device# configure terminal
Device(config)# router bgp 65000
Device(config-router)# neighbor 30.1.1.1 bmp-activate server 1 server 2
Device(config-router)# end
```

The following example shows how to configure initial refresh delay of 30 seconds for BGP neighbors on which BMP is activated using the **neighbor bmp-activate** command:

```
Device> enable
Device# configure terminal
Device(config)# router bgp 65000
Device(config-router)# bmp initial-refresh delay 30
Device(config-router)# bmp buffer-size 2048
Device(config-router)# end
```

The following example show how to enter BMP server configuration mode and initiate connection between a specific BMP server with the BGP BMP neighbors. In this example, connection to clients is initiated from BMP servers 1 and 2 along with configuration of the monitoring parameters:

```
Device> enable
Device# configure terminal
Device(config)# router bgp 65000
Device(config-router)# bmp server 1
Device(config-router-bmpsrvr)# activate
Device(config-router-bmpsrvr)# address 10.1.1.1 port-number 8000
Device(config-router-bmpsrvr)# description LINE SERVER1
Device(config-router-bmpsrvr)# failure-retry-delay 40
Device(config-router-bmpsrvr)# flapping-delay 120
Device(config-router-bmpsrvr)# initial-delay 20
Device(config-router-bmpsrvr)# set ip dscp 5
Device(config-router-bmpsrvr)# stats-reporting-period 30
Device(config-router-bmpsrvr)# update-source ethernet 0/0
Device(config-router-bmpsrvr)# exit-bmp-server-mode
Device(config-router)# bmp server 2
Device(config-router-bmpsrvr)# activate
```

```
Device(config-router-bmpsrvr)# address 20.1.1.1 port-number 9000
Device(config-router-bmpsrvr)# description LINE SERVER2
Device(config-router-bmpsrvr)# failure-retry-delay 40
Device(config-router-bmpsrvr)# flapping-delay 120
Device(config-router-bmpsrvr)# initial-delay 20
Device(config-router-bmpsrvr)# set ip dscp 7
Device(config-router-bmpsrvr)# stats-reporting-period 30
Device(config-router-bmpsrvr)# update-source ethernet 2/0
Device(config-router-bmpsrvr)# exit-bmp-server-mode
Device(config-router)# end
```

The following example shows how to activate BMP on a VRF neighbor with IP address 10.1.1.1, which is monitored by BMP servers (in this case, server 1 and 2):

```
Device> enable
Device# configure terminal
Device(config)# router bgp 65000
Device (config-router)# address-family 10.1.1.1 vrf vrf1
Device(config-router)# neighbor 10.1.1.1 bmp-activate server 1 server 2
Device(config-router)# end
```

Examples: Verifying BGP Monitoring Protocol

The following is sample output from the **show ip bgp bmp server** command for server number 1. The attributes displayed are configured in the BMP server configuration mode:

```
Device# show ip bgp bmp server 1

Print detailed info for 1 server number 1.

bmp server 1
address: 10.1.1.1    port 8000
description SERVER1
up time 00:06:22
session-startup route-refresh
initial-delay 20
failure-retry-delay 40
flapping-delay 120
activated
```

The following is sample output from the **show ip bgp bmp server** command for server number 2. The attributes displayed are configured in the BMP server configuration mode:

```
Device# show ip bgp bmp server 2

Print detailed info for 1 server number 2.

bmp server 2
address: 20.1.1.1    port 9000
description SERVER2
up time 00:06:23
session-startup route-refresh
initial-delay 20
failure-retry-delay 40
flapping-delay 120
activated
```

The following is sample output from the **show ip bgp bmp server summary** command after deactivating the BMP server 1 and 2 connections:

```
Device# show ip bgp bmp server summary

Number of BMP servers configured: 2
Number of BMP neighbors configured: 10
Number of neighbors on TransitionQ: 0, MonitoringQ: 0, ConfigQ: 0
Number of BMP servers on StatsQ: 0
BMP Refresh not in progress, refresh not scheduled
Initial Refresh Delay configured, refresh value 30s
BMP buffer size configured, buffer size 2048 MB, buffer size bytes used 0 MB

ID Host/Net          Port  TCB                Status  Uptime    MsgSent   LastStat
1  10.1.1.1          8000  0x0                Down              0
2  20.1.1.1          9000  0x0                Down              0
```

The following is sample output from the **show ip bgp bmp neighbors** command, which shows the status of the BGP BMP neighbors after reactivating the BMP server 1 and 2 connections:

```
Device# show ip bgp bmp server neighbors

Number of BMP neighbors configured: 10
BMP Refresh not in progress, refresh not scheduled
Initial Refresh Delay configured, refresh value 30s
BMP buffer size configured, buffer size 2048 MB, buffer size bytes used 0 MB

Neighbor           PriQ      MsgQ      CfgSvr#            ActSvr#            RM Sent
30.1.1.1           0         0         1  2               1  2               16
2001:DB8::2001     0         0         1  2               1  2               15
40.1.1.1           0         0         1  2               1  2               26
2001:DB8::2002     0         0         1  2               1  2               15
50.1.1.1           0         0         1  2               1  2               16
60.1.1.1           0         0         1  2               1  2               26
2001:DB8::2002     0         0         1                  1                  9
70.1.1.1           0         0         2                  2                  12
Neighbor           PriQ      MsgQ      CfgSvr#            ActSvr#            RM Sent
80.1.1.1           0         0         1                  1                  10
2001:DB8::2002     0         0         1  2               1  2               16
```

The following is sample output from the **show ip bgp bmp server** command for BMP server number 1 and 2. The statistics reporting interval on BMP server 1 and 2 has been set to 30 seconds, therefore each server receives statistics messages from its connected BGP BMP neighbor in each cycle of 30 seconds:

```
Device# show ip bgp bmp server summary

Number of BMP servers configured: 2
Number of BMP neighbors configured: 10
Number of neighbors on TransitionQ: 0, MonitoringQ: 0, ConfigQ: 0
Number of BMP servers on StatsQ: 0
BMP Refresh not in progress, refresh not scheduled
Initial Refresh Delay configured, refresh value 30s
BMP buffer size configured, buffer size 2048 MB, buffer size bytes used 0 MB

ID Host/Net          Port  TCB                Status  Uptime    MsgSent   LastStat
1  10.1.1.1          8000  0x2A98B07138       Up      00:38:49  162       00:00:09
2  20.1.1.1          9000  0x2A98E17C88       Up      00:38:49  46        00:00:04
```

```
Device# show ip bgp bmp server summary

Number of BMP servers configured: 2
```

```
Number of BMP neighbors configured: 10
Number of neighbors on TransitionQ: 0, MonitoringQ: 0, ConfigQ: 0
Number of BMP servers on StatsQ: 0
BMP Refresh not in progress, refresh not scheduled
Initial Refresh Delay configured, refresh value 30s
BMP buffer size configured, buffer size 2048 MB, buffer size bytes used 0 MB

ID Host/Net          Port  TCB                Status  Uptime    MsgSent   LastStat
1  10.1.1.1          8000  0x2A98B07138       Up      00:40:19  189       00:00:07
2  20.1.1.1          9000  0x2A98E17C88       Up      00:40:19  55        00:00:02
```

Note If we configure several BGP BMP neighbors to be monitored by the BMP servers, for example 10, then 10 statistics messages are received by both servers in each periodic cycle that is configured.

The following is sample output from the **show running-config** command, which shows the running configuration on the device:

```
Device# show running-config | section bmp

bmp server 1
address 10.1.1.1 port-number 8000
description SERVER1
initial-delay 20
failure-retry-delay 40
flapping-delay 120
update-source Ethernet0/0
set ip dscp 3
activate
exit-bmp-server-mode
bmp server 2
address 20.1.1.1 port-number 9000
description SERVER2
initial-delay 20
failure-retry-delay 40
flapping-delay 120
update-source Ethernet2/0
set ip dscp 5
activate
exit-bmp-server-mode
bmp initial-refresh delay 30
bmp-activate all
```

Examples: Monitoring BGP Monitoring Protocol

The following example shows how to enable debugging of the various BMP attributes:

```
Device# debug ip bgp bmp event

BGP BMP events debugging is on

Device# debug ip bgp bmp neighbor

BGP BMP neighbor debugging is on

Device# debug ip bgp bmp server

BGP BMP server debugging is on
```

The following is sample output from the **show debugging** command after you enable the BGP BMP server debugging:

```
Device# show debugging

IP routing:
BGP BMP server debugging is on

Device#

*Apr  8 21:04:13.164: BGPBMP: BMP server connection attempt timer expired for server 1 -
10.1.1.1/8000
*Apr  8 21:04:13.165: BGPBMP: BMP server 1 active open process success - 10.1.1.1/8000
*Apr  8 21:04:13.165: BGPBMP: TCP KA interval is set to 15

Device#

*Apr  8 21:04:15.171: BGPBMP: Register read/write notification callbacks with BMP server 1
 TCB - 10.1.1.1/8000
*Apr  8 21:04:15.171: BGPBMP: Initiation msg sent to BMP server 1 - 10.1.1.1/8000
*Apr  8 21:04:15.171: BGPBMP: BMP server 1 connection - 10.1.1.1/8000 up, invoke refresh
event

Device#

*Apr  8 21:04:16.249: BGPBMP: BMP server connection attempt timer expired for server 2 -
20.1.1.1/9000
*Apr  8 21:04:16.249: BGPBMP: BMP server 2 active open process success - 20.1.1.1/9000
*Apr  8 21:04:16.249: BGPBMP: TCP KA interval is set to 15
*Apr  8 21:04:16.250: BGPBMP: Register read/write notification callbacks with BMP server 2
 TCB - 20.1.1.1/9000
*Apr  8 21:04:16.250: BGPBMP: Initiation msg sent to BMP server 2 - 20.1.1.1/9000
*Apr  8 21:04:16.250: BGPBMP: BMP server 2 connection - 20.1.1.1/9000 up, invoke refresh
event
```

Additional References for BGP Monitoring Protocol

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
BGP commands	Cisco IOS IP Routing: BGP Command Reference

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History for BGP Monitoring Protocol

This table provides release and related information for the features explained in this module.

These features are available on all the releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Bengaluru 17.5.1	BGP Monitoring Protocol	The BGP Monitoring Protocol feature supports configuring devices to function as BMP servers, monitoring BGP neighbors and generating statistics reports for BGP neighbors. BMP also performs appropriate error handling, graceful scale up and closing connectivity between BMP servers and BGP neighbors. Support for this feature was introduced on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X, C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

Use the Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to https://cfnng.cisco.com/.