iBGP Multipath Load Sharing

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This feature module describes the iBGP Multipath Load Sharing feature.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for iBGP Multipath Load Sharing

- Route Reflector Limitation--With multiple iBGP paths installed in a routing table, a route reflector will advertise only one of the paths (one next hop).
- Memory Consumption Restriction--Each IP routing table entry for a BGP prefix that has multiple iBGP paths uses approximately 350 bytes of additional memory. We recommend not using this feature on a router with a low amount of available memory and especially when the router is carrying a full Internet routing table.
- The iBGP Multipath Load Sharing feature is supported for the following platforms in Cisco IOS Release 12.2(14)S:

◦ Cisco 7200 series
◦ Cisco 7400 series
◦ Cisco 7500 series

Information about iBGP Multipath Load Sharing

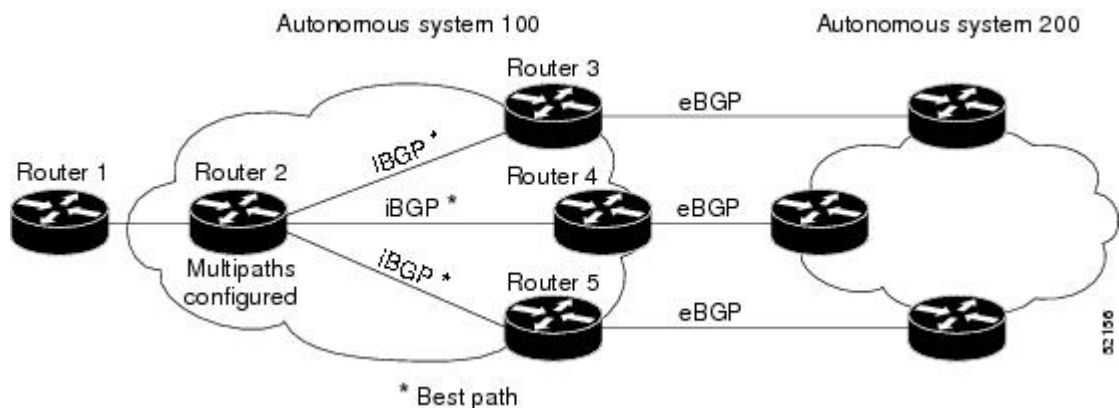## iBGP Multipath Load Sharing Overview

When a Border Gateway Protocol (BGP) speaking router with no local policy configured receives multiple network layer reachability information (NLRI) from the internal BGP (iBGP) for the same destination, the router will choose one iBGP path as the best path. The best path is then installed in the IP routing table of the router. For example, in the figure below, although there are three paths to autonomous system 200, Router 2 determines that one of the paths to autonomous system 200 is the best path and uses this path only to reach autonomous system 200.

Figure 1   *Non-MPLS Topology with One Best Path*
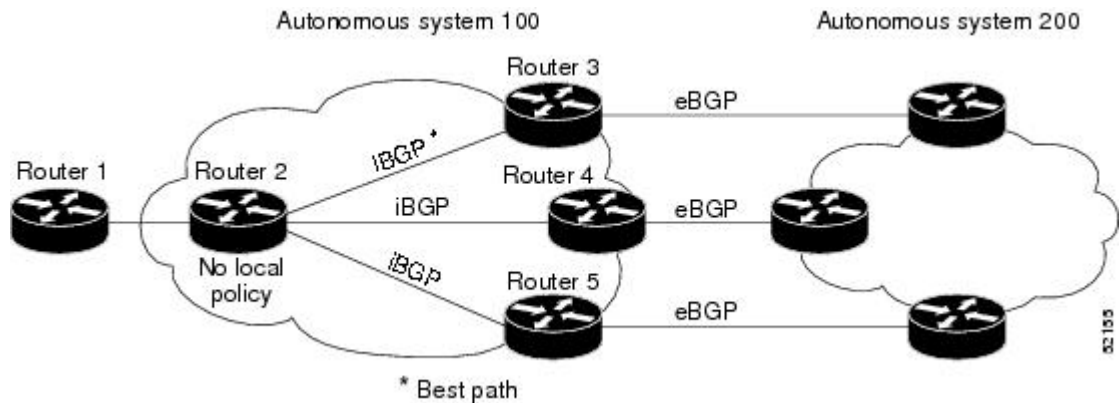
The iBGP Multipath Load Sharing feature enables the BGP speaking router to select multiple iBGP paths as the best paths to a destination. The best paths or multipaths are then installed in the IP routing table of the router. For example, on router 2 in the figure below, the paths to routers 3, 4, and 5 are configured as multipaths and can be used to reach autonomous system 200, thereby equally sharing the load to autonomous system 200.

Figure 2   *Non-MPLS Topology with Three Multipaths*

The iBGP Multipath Load Sharing feature functions similarly in a Multiprotocol Label Switching (MPLS) Virtual Private Network (VPN) with a service provider backbone. For example, on router PE1 in the figure below, the paths to routers PE2, PE3, and PE4 can be selected as multipaths and can be used to equally share the load to site 2.

Figure 3   *MPLS VPN with Three Multipaths*
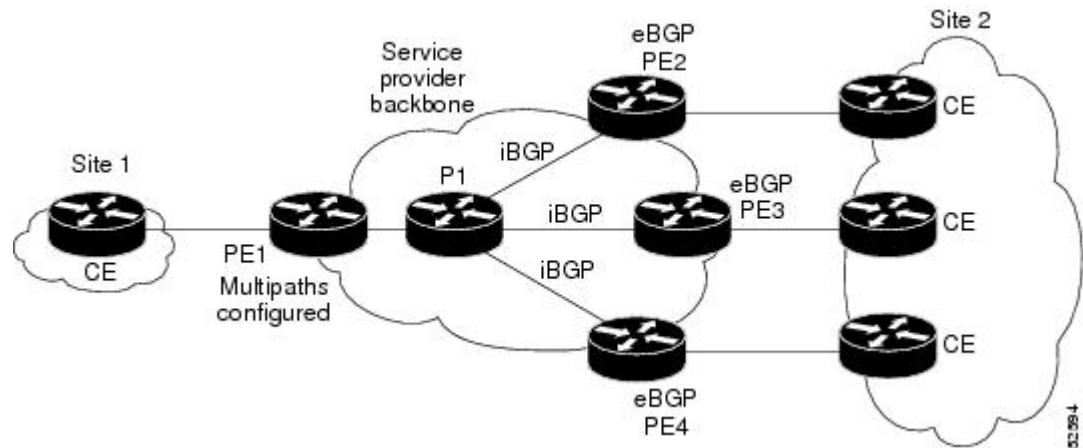
For multiple paths to the same destination to be considered as multipaths, the following criteria must be met:

- All attributes must be the same. The attributes include weight, local preference, autonomous system path (entire attribute and not just length), origin code, Multi Exit Discriminator (MED), and Interior Gateway Protocol (IGP) distance.
- The next hop router for each multipath must be different.

Even if the criteria are met and multiple paths are considered multipaths, the BGP speaking router will still designate one of the multipaths as the best path and advertise this best path to its neighbors.

The iBGP Multipath Load Sharing feature is similar to BGP multipath support for external BGP (eBGP) paths; however, the iBGP Multipath Load Sharing feature is applied to internal rather than eBGP paths.

Benefits of iBGP Multipath Load Sharing

Configuring multiple iBGP best paths enables a router to evenly share the traffic destined for a particular site.

How To Configure iBGP Multipath Load Sharing

Configuring iBGP Multipath Load Sharing

To configure the iBGP Multipath Load Sharing feature, use the following command in router configuration mode:

Command	Purpose
`Router(config-router)#` **maximum-paths ibgp** *maximum-number*	Controls the maximum number of parallel iBGP routes that can be installed in a routing table.

Verifying iBGP Multipath Load Sharing

To verify that the iBGP Multipath Load Sharing feature is configured correctly, perform the following steps:

SUMMARY STEPS

1. Enter the **show ip bgp** *network-number* EXEC command to display attributes for a network in a non-MPLS topology, or the **show ip bgp vpnv4 all** *ip-prefix*EXEC commandtodisplay attributes for a network in an MPLS VPN:

2. In the display resulting from the **show ip bgp** *network-number* EXEC command or the **show ip bgp vpnv4 all** *ip-prefix*EXEC command, verify that the intended multipaths are marked as "multipaths." Notice that one of the multipaths is marked as "best."

3. Enter the **show ip route** *ip-address* EXEC command to display routing information for a network in a non-MPLS topology or the **show ip route vrf** *vrf-name ip-prefix* EXEC command to display routing information for a network in an MPLS VPN:

4. Verify that the paths marked as "multipath" in the display resulting from the **show ip bgp** *ip-prefix*EXEC command or the **show ip bgp vpnv4 all** *ip-prefix* EXEC command are included in the routing information. (The routing information is displayed after performing Step 3.)

DETAILED STEPS

Step 1 Enter the **show ip bgp** *network-number* EXEC command to display attributes for a network in a non-MPLS topology, or the **show ip bgp vpnv4 all** *ip-prefix*EXEC commandtodisplay attributes for a network in an MPLS VPN:

Example:

```
Router# show ip bgp 10.22.22.0
BGP routing table entry for 10.22.22.0/24, version 119
Paths:(6 available, best #1)
Multipath:iBGP
Flag:0x820
  Advertised to non peer-group peers:
  10.1.12.12
  22
    10.2.3.8 (metric 11) from 10.1.3.4 (100.0.0.5)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath, best
      Originator:100.0.0.5, Cluster list:100.0.0.4
  22
    10.2.1.9 (metric 11) from 10.1.1.2 (100.0.0.9)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath
      Originator:100.0.0.9, Cluster list:100.0.0.2
  22
    10.2.5.10 (metric 11) from 10.1.5.6 (100.0.0.10)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath
      Originator:100.0.0.10, Cluster list:100.0.0.6
  22
    10.2.4.10 (metric 11) from 10.1.4.5 (100.0.0.10)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath
      Originator:100.0.0.10, Cluster list:100.0.0.5
```

```
     22
       10.2.6.10 (metric 11) from 10.1.6.7 (100.0.0.10)
         Origin IGP, metric 0, localpref 100, valid, internal, multipath
         Originator:100.0.0.10, Cluster list:100.0.0.7
Router# show ip bgp vpnv4 all 10.22.22.0
BGP routing table entry for 100:1:10.22.22.0/24, version 50
Paths:(6 available, best #1)
Multipath:iBGP
  Advertised to non peer-group peers:
  200.1.12.12
  22
    10.22.7.8 (metric 11) from 10.11.3.4 (100.0.0.8)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath, best
      Extended Community:RT:100:1
      Originator:100.0.0.8, Cluster list:100.1.1.44
  22
    10.22.1.9 (metric 11) from 10.11.1.2 (100.0.0.9)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath
      Extended Community:RT:100:1
      Originator:100.0.0.9, Cluster list:100.1.1.22
  22
    10.22.6.10 (metric 11) from 10.11.6.7 (100.0.0.10)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath
      Extended Community:RT:100:1
      Originator:100.0.0.10, Cluster list:100.0.0.7
  22
    10.22.4.10 (metric 11) from 10.11.4.5 (100.0.0.10)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath
      Extended Community:RT:100:1
      Originator:100.0.0.10, Cluster list:100.0.0.5
  22
    10.22.5.10 (metric 11) from 10.11.5.6 (100.0.0.10)
      Origin IGP, metric 0, localpref 100, valid, internal, multipath
      Extended Community:RT:100:1
      Originator:100.0.0.10, Cluster list:100.0.0.6
```

Step 2   In the display resulting from the **show ip bgp** *network-number* EXEC command or the **show ip bgp vpnv4 all** *ip-prefix*EXEC command, verify that the intended multipaths are marked as "multipaths." Notice that one of the multipaths is marked as "best."

Step 3   Enter the **show ip route** *ip-address* EXEC command to display routing information for a network in a non-MPLS topology or the **show ip route vrf** *vrf-name ip-prefix* EXEC command to display routing information for a network in an MPLS VPN:

Example:

```
Router# show ip route 10.22.22.0
Routing entry for 10.22.22.0/24
  Known via "bgp 1", distance 200, metric 0
  Tag 22, type internal
  Last update from 10.2.6.10 00:00:03 ago
  Routing Descriptor Blocks:
  * 10.2.3.8, from 10.1.3.4, 00:00:03 ago
      Route metric is 0, traffic share count is 1
      AS Hops 1
    10.2.1.9, from 10.1.1.2, 00:00:03 ago
      Route metric is 0, traffic share count is 1
      AS Hops 1
    10.2.5.10, from 10.1.5.6, 00:00:03 ago
      Route metric is 0, traffic share count is 1
      AS Hops 1
    10.2.4.10, from 10.1.4.5, 00:00:03 ago
      Route metric is 0, traffic share count is 1
      AS Hops 1
    10.2.6.10, from 10.1.6.7, 00:00:03 ago
      Route metric is 0, traffic share count is 1
      AS Hops 1
Router# show ip route vrf PATH 10.22.22.0
Routing entry for 10.22.22.0/24
```

```
Known via "bgp 1", distance 200, metric 0
Tag 22, type internal
Last update from 10.22.5.10 00:01:07 ago
Routing Descriptor Blocks:
* 10.22.7.8 (Default-IP-Routing-Table), from 10.11.3.4, 00:01:07 ago
    Route metric is 0, traffic share count is 1
    AS Hops 1
  10.22.1.9 (Default-IP-Routing-Table), from 10.11.1.2, 00:01:07 ago
    Route metric is 0, traffic share count is 1
    AS Hops 1
  10.22.6.10 (Default-IP-Routing-Table), from 10.11.6.7, 00:01:07 ago
    Route metric is 0, traffic share count is 1
    AS Hops 1
  10.22.4.10 (Default-IP-Routing-Table), from 10.11.4.5, 00:01:07 ago
    Route metric is 0, traffic share count is 1
    AS Hops 1
  10.22.5.10 (Default-IP-Routing-Table), from 10.11.5.6, 00:01:07 ago
    Route metric is 0, traffic share count is 1
    AS Hops 1
```

Step 4   Verify that the paths marked as "multipath" in the display resulting from the **show ip bgp** *ip-prefix* EXEC command or the **show ip bgp vpnv4 all** *ip-prefix* EXEC command are included in the routing information. (The routing information is displayed after performing Step 3.)

Monitoring and Maintaining iBGP Multipath Load Sharing

To display iBGP Multipath Load Sharing information, use the following commands in EXEC mode, as needed:

| Command	Purpose
Router# **show ip bgp** *ip-prefix*	Displays attributes and multipaths for a network in a non-MPLS topology.
Router# **show ip bgp vpnv4 all** *ip-prefix*	Displays attributes and multipaths for a network in an MPLS VPN.
Router# **show ip route** *ip-prefix*	Displays routing information for a network in a non-MPLS topology.
Router# **show ip route vrf** *vrf-name ip-prefix*	Displays routing information for a network in an MPLS VPN.

Configuration Examples for iBGP Multipath Load Sharing

The examples assume that the appropriate attributes for each path are equal and that the next hop router for each multipath is different.

Example iBGP Multipath Load Sharing in a Non-MPLS Topology

The following example shows how to set up the iBGP Multipath Load Sharing feature in a non-MPLS topology (see the figure below).
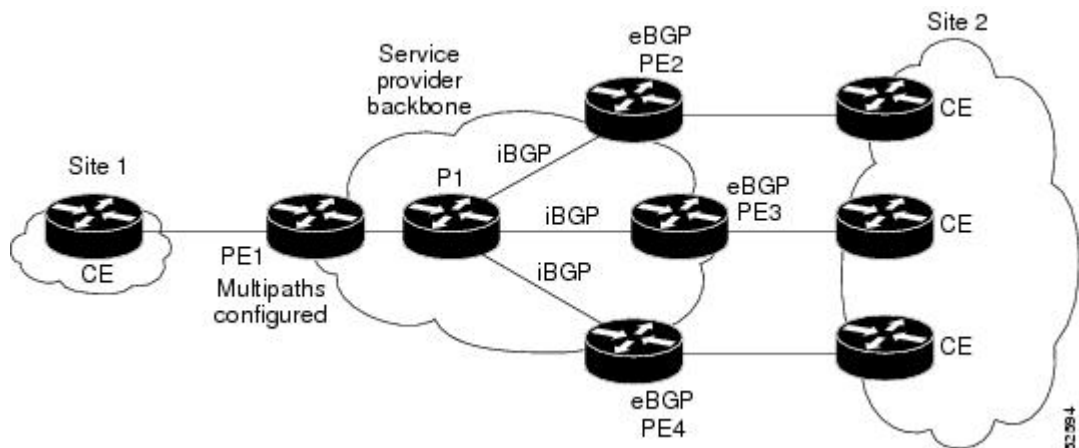
Figure 4   *Non-MPLS Topology Example*
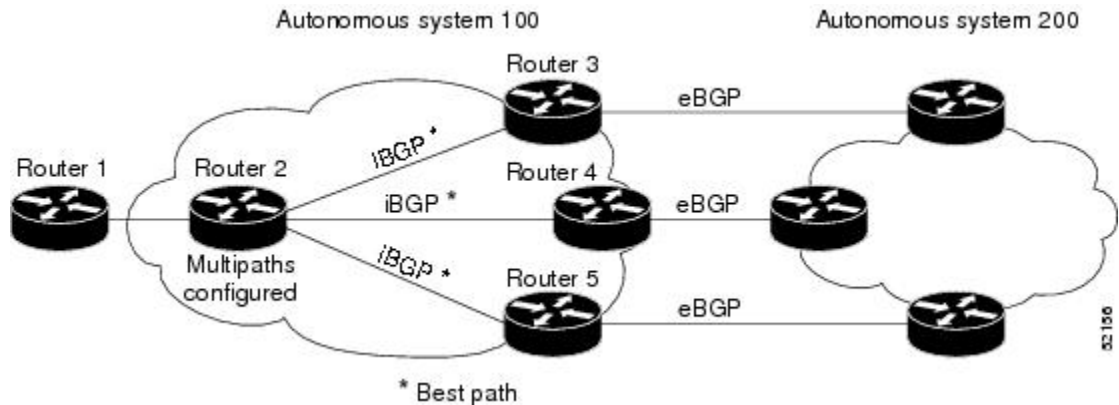
Router 2 Configuration

```
router bgp 100
maximum-paths ibgp 3
```

Example iBGP Multipath Load Sharing in an MPLS VPN Topology

The following example shows how to set up the iBGP Multipath Load Sharing feature in an MPLS VPN topology (see the figure below).

Figure 5   *MPLS VPN Topology Example*

Router PE1 Configuration

```
router bgp 100
```

```
address-family ipv4 unicast vrf site2
 maximum-paths ibgp 3
```

Additional References

The following sections provide references related to the iBGP Multipath Load Sharing feature.

Related Documents

Related Topic	Document Title
BGP multipath load sharing for both eBGP and iBGP in an MPLS-VPN	"BGP Multipath Load Sharing for Both eBGP and iBGP in an MPLS-VPN"
Advertising the bandwidth of an autonomous system exit link as an extended community	" BGP Link Bandwidth"
BGP commands	*Cisco IOS IP Routing: BGP Command Reference*
Cisco IOS master command list, all releases	Cisco IOS Master Command List, All Releases

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

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/techsupport

Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS IP Routing: BGP Command Reference*. For information about all Cisco IOS commands, go to the Command Lookup Tool at http://tools.cisco.com/Support/CLILookup or to the *Cisco IOS Master Commands List*.

New Commands

- **maximum-paths ibgp**

Modified Commands

- **show ip bgp**
- **show ip bgp vpnv4**
- **show ip route**
- **show ip route vrf**

Feature Information for iBGP Multipath Load Sharing

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1   *Feature Information for iBGP Multipath Load Sharing*

Feature Name	Releases	Feature Information
iBGP Multipath Load Sharing	12.2(14)S 12.2(2)T	The iBGP Multipath Load Sharing feature enables the BGP speaking router to select multiple iBGP paths as the best paths to a destination. The following commands were introduced or modified: **maximum-paths ibgp**, **show ip bgp**, **show ip bgp vpnv4**, **show ip route**, **show ip route vrf**.