



## BGP Link Bandwidth

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The Border Gateway Protocol (BGP) Link Bandwidth feature is used to advertise the bandwidth of an autonomous system exit link as an extended community. This feature is configured for links between directly connected external BGP (eBGP) neighbors. The link bandwidth extended community attribute is propagated to iBGP peers when extended community exchange is enabled. This feature is used with BGP multipath features to configure load balancing over links with unequal bandwidth.

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## Prerequisites for BGP Link Bandwidth

- BGP load balancing or multipath load balancing must be configured before BGP Link Bandwidth feature is enabled.
- BGP extended community exchange must be enabled between iBGP neighbors to which the link bandwidth attribute is to be advertised.
- Cisco Express Forwarding or distributed Cisco Express Forwarding must be enabled on all participating routers.

## Restrictions for BGP Link Bandwidth

- The BGP Link Bandwidth feature can be configured only under IPv4 and VPNv4 address family sessions.
- BGP can originate the link bandwidth community only for directly connected links to eBGP neighbors.
- Both iBGP and eBGP load balancing are supported in IPv4 and VPNv4 address families. However, eiBGP load balancing is supported only in VPNv4 address families.

# Information About BGP Link Bandwidth

## BGP Link Bandwidth Overview

The BGP Link Bandwidth feature is used to enable multipath load balancing for external links with unequal bandwidth capacity. This feature is enabled under an IPv4 or VPNv4 address family session by entering the **bgp dmzlink-bw** command. This feature supports iBGP, eBGP multipath load balancing, and eiBGP multipath load balancing in Multiprotocol Label Switching (MPLS) VPNs. When this feature is enabled, routes learned from directly connected external neighbor are propagated through the internal BGP (iBGP) network with the bandwidth of the source external link.

The link bandwidth extended community indicates the preference of an autonomous system exit link in terms of bandwidth. This extended community is applied to external links between directly connected eBGP peers by entering the **neighbor dmzlink-bw** command. The link bandwidth extended community attribute is propagated to iBGP peers when extended community exchange is enabled with the **neighbor send-community** command.

## Link Bandwidth Extended Community Attribute

The link bandwidth extended community attribute is a 4-byte value that is configured for a link on the demilitarized zone (DMZ) interface that connects two single hop eBGP peers. The link bandwidth extended community attribute is used as a traffic sharing value relative to other paths while traffic is being forwarded. Two paths are designated as equal for load balancing if the weight, local-pref, as-path length, Multi Exit Discriminator (MED), and Interior Gateway Protocol (IGP) costs are the same.

## Benefits of the BGP Link Bandwidth Feature

The BGP Link Bandwidth feature allows BGP to be configured to send traffic over multiple iBGP or eBGP learned paths where the traffic that is sent is proportional to the bandwidth of the links that are used to exit the autonomous system. The configuration of this feature can be used with eBGP and iBGP multipath features to enable unequal cost load balancing over multiple links. Unequal cost load balancing over links with unequal bandwidth was not possible in BGP before the BGP Link Bandwidth feature was introduced.

# How to Configure BGP Link Bandwidth

## Configuring BGP Link Bandwidth

To configure the BGP Link Bandwidth feature, perform the steps in this section.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *autonomous-system-number*
4. **address-family ipv4** [**mdt** | **multicast** | **tunnel** | **unicast** [**vrf vrf-name**] | **vrf vrf-name**] | **vpn4** [**unicast**]

5. **bgp dmzlink-bw**
6. **neighbor** *ip-address* **dmzlink-bw**
7. **neighbor** *ip-address* **send-community** [**both** | **extended** | **standard**]
8. **end**

## DETAILED STEPS

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> <pre>Router&gt; enable</pre>	Enables higher privilege levels, such as privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b>	<b>router bgp</b> <i>autonomous-system-number</i> <b>Example:</b> <pre>Router(config)# router bgp 50000</pre>	Enters router configuration mode to create or configure a BGP routing process.
<b>Step 4</b>	<b>address-family ipv4</b> [ <b>mdt</b>   <b>multicast</b>   <b>tunnel</b>   <b>unicast</b>   <b>vrf</b> <i>vrf-name</i> ]   <b>vrf</b> <i>vrf-name</i> ]   <b>vpnvp4</b> [ <b>unicast</b> ] <b>Example:</b> <pre>Router(config-router)# address-family ipv4</pre>	Enters address family configuration mode. <ul style="list-style-type: none"> <li>• The BGP Link Bandwidth feature is supported only under the IPv4 and VPNv4 address families.</li> </ul>
<b>Step 5</b>	<b>bgp dmzlink-bw</b> <b>Example:</b> <pre>Router(config-router-af)# bgp dmzlink-bw</pre>	Configures BGP to distribute traffic proportionally to the bandwidth of the link. <ul style="list-style-type: none"> <li>• This command must be entered on each router that contains an external interface that is to be used for multipath load balancing.</li> </ul>
<b>Step 6</b>	<b>neighbor</b> <i>ip-address</i> <b>dmzlink-bw</b> <b>Example:</b> <pre>Router(config-router-af)# neighbor 172.16.1.1 dmzlink-bw</pre>	Configures BGP to include the link bandwidth attribute for routes learned from the external interface specified IP address. <ul style="list-style-type: none"> <li>• This command must be configured for each eBGP link that is to be configured as a multipath. Enabling this command allows the bandwidth of the external link to be propagated through the link bandwidth extended community.</li> </ul>

	Command or Action	Purpose
<b>Step 7</b>	<b>neighbor</b> <i>ip-address</i> <b>send-community</b> [ <b>both</b>   <b>extended</b>   <b>standard</b> ] <b>Example:</b> <pre>Router(config-router-af) # neighbor 10.10.10.1 send-community extended</pre>	(Optional) Enables community and/or extended community exchange with the specified neighbor. <ul style="list-style-type: none"> <li>This command must be configured for iBGP peers to which the link bandwidth extended community attribute is to be propagated.</li> </ul>
<b>Step 8</b>	<b>end</b> <b>Example:</b> <pre>Router(config-router-af) # end</pre>	Exits address family configuration mode, and enters Privileged EXEC mode.

## Verifying BGP Link Bandwidth Configuration

To verify the BGP Link Bandwidth feature, perform the steps in this section.

### SUMMARY STEPS

- enable**
- show ip bgp** *ip-address* [**longer-prefixes** [**injected**] | **shorter-prefixes** [*mask-length*]]
- show ip route** [[*ip-address* [*mask*] [**longer-prefixes**]] | [*protocol* [*process-id*]] | [**list** *access-list-number* | *access-list-name*] | [**static download**]]

### DETAILED STEPS

#### Procedure

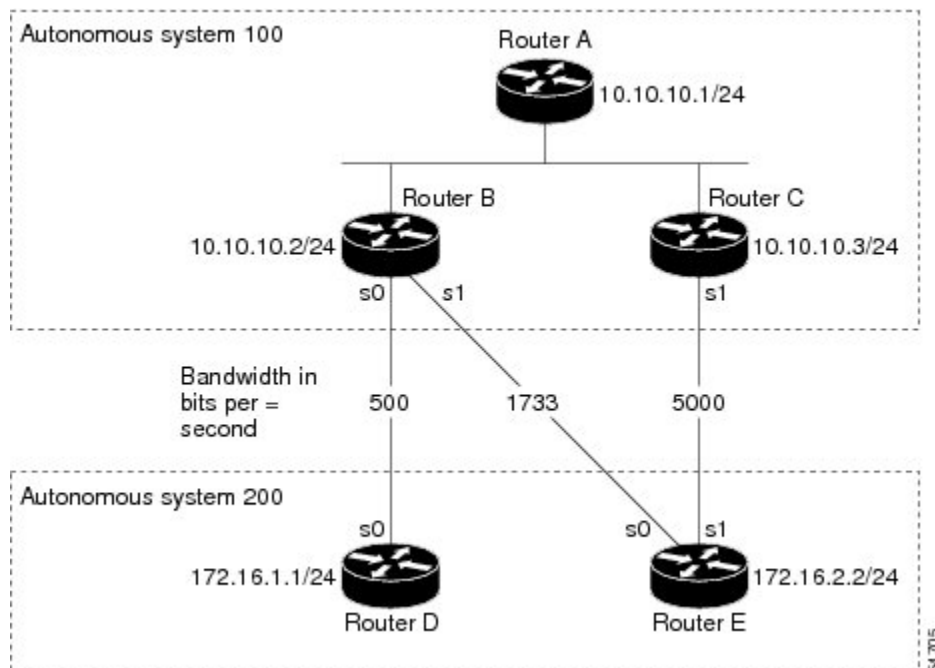
	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> <pre>Router&gt; enable</pre>	Enables higher privilege levels, such as privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>show ip bgp</b> <i>ip-address</i> [ <b>longer-prefixes</b> [ <b>injected</b> ]   <b>shorter-prefixes</b> [ <i>mask-length</i> ]] <b>Example:</b> <pre>Router# show ip bgp 10.0.0.0</pre>	Displays information about the TCP and BGP connections to neighbors. <ul style="list-style-type: none"> <li>The output displays the status of the link bandwidth configuration. The bandwidth of the link is shown in kilobytes.</li> </ul>
<b>Step 3</b>	<b>show ip route</b> [[ <i>ip-address</i> [ <i>mask</i> ] [ <b>longer-prefixes</b> ]]   [ <i>protocol</i> [ <i>process-id</i> ]]   [ <b>list</b> <i>access-list-number</i>   <i>access-list-name</i> ]   [ <b>static download</b> ]] <b>Example:</b> <pre>Router# show ip route 10.0.0.0</pre>	Displays the current state of the routing table. <ul style="list-style-type: none"> <li>The output displays traffic share values, including the weights of the links that are used to direct traffic proportionally to the bandwidth of each link.</li> </ul>

# Configuration Examples for BGP Link Bandwidth

## BGP Link Bandwidth Configuration Example

In the following examples, the BGP Link Bandwidth feature is configured so BGP will distribute traffic proportionally to the bandwidth of each external link. The figure below shows two external autonomous systems connected by three links that each carry a different amount of bandwidth (unequal cost links). Multipath load balancing is enabled and traffic is balanced proportionally.

Figure 1: BGP Link Bandwidth Configuration



### Router A Configuration

In the following example, Router A is configured to support iBGP multipath load balancing and to exchange the BGP extended community attribute with iBGP neighbors:

```
Router A(config)# router bgp 100
Router A(config-router)# neighbor 10.10.10.2 remote-as 100
Router A(config-router)# neighbor 10.10.10.2 update-source Loopback 0
Router A(config-router)# neighbor 10.10.10.3 remote-as 100
Router A(config-router)# neighbor 10.10.10.3 update-source Loopback 0
Router A(config-router)# address-family ipv4
Router A(config-router)# bgp dmzlink-bw
Router A(config-router-af)# neighbor 10.10.10.2 activate
```

```

Router A(config-router-af)# neighbor 10.10.10.2 send-community both
Router A(config-router-af)# neighbor 10.10.10.3 activate
Router A(config-router-af)# neighbor 10.10.10.3 send-community both
Router A(config-router-af)# maximum-paths ibgp 6

```

### Router B Configuration

In the following example, Router B is configured to support multipath load balancing, to distribute Router D and Router E link traffic proportionally to the bandwidth of each link, and to advertise the bandwidth of these links to iBGP neighbors as an extended community:

```

Router B(config)# router bgp 100
Router B(config-router)# neighbor 10.10.10.1 remote-as 100
Router B(config-router)# neighbor 10.10.10.1 update-source Loopback 0
Router B(config-router)# neighbor 10.10.10.3 remote-as 100
Router B(config-router)# neighbor 10.10.10.3 update-source Loopback 0
Router B(config-router)# neighbor 172.16.1.1 remote-as 200
Router B(config-router)# neighbor 172.16.1.1 ebgp-multihop 1
Router B(config-router)# neighbor 172.16.2.2 remote-as 200
Router B(config-router)# neighbor 172.16.2.2 ebgp-multihop 1
Router B(config-router)# address-family ipv4
Router B(config-router-af)# bgp dmzlink-bw
Router B(config-router-af)# neighbor 10.10.10.1 activate
Router B(config-router-af)# neighbor 10.10.10.1 next-hop-self
Router B(config-router-af)# neighbor 10.10.10.1 send-community both
Router B(config-router-af)# neighbor 10.10.10.3 activate
Router B(config-router-af)# neighbor 10.10.10.3 next-hop-self
Router B(config-router-af)# neighbor 10.10.10.3 send-community both
Router B(config-router-af)# neighbor 172.16.1.1
activate
Router B(config-router-af)# neighbor 172.16.1.1 dmzlink-bw
Router B(config-router-af)# neighbor 172.16.2.2 activate
Router B(config-router-af)# neighbor 172.16.2.2 dmzlink-bw
Router B(config-router-af)# maximum-paths ibgp 6
Router B(config-router-af)# maximum-paths 6

```

### Router C Configuration

In the following example, Router C is configured to support multipath load balancing and to advertise the bandwidth of the link with Router E to iBGP neighbors as an extended community:

```

Router C(config)# router bgp 100
Router C(config-router)# neighbor 10.10.10.1 remote-as 100
Router C(config-router)# neighbor 10.10.10.1 update-source Loopback 0
Router C(config-router)# neighbor 10.10.10.2 remote-as 100
Router C(config-router)# neighbor 10.10.10.2 update-source Loopback 0
Router C(config-router)# neighbor 172.16.3.30 remote-as 200
Router C(config-router)# neighbor 172.16.3.30 ebgp-multihop 1
Router C(config-router)# address-family ipv4
Router C(config-router-af)# bgp dmzlink-bw

Router C(config-router-af)# neighbor 10.10.10.1 activate
Router C(config-router-af)# neighbor 10.10.10.1 send-community both
Router C(config-router-af)# neighbor 10.10.10.1 next-hop-self
Router C(config-router-af)# neighbor 10.10.10.2 activate
Router C(config-router-af)# neighbor 10.10.10.2 send-community both
Router C(config-router-af)# neighbor 10.10.10.2 next-hop-self
Router C(config-router-af)# neighbor 172.16.3.3 activate
Router C(config-router-af)# neighbor 172.16.3.3 dmzlink-bw

Router C(config-router-af)# maximum-paths ibgp 6
Router C(config-router-af)# maximum-paths 6

```

## Verifying BGP Link Bandwidth

The examples in this section show the verification of this feature on Router A and Router B.

### Router B

In the following example, the **show ip bgp** command is entered on Router B to verify that two unequal cost best paths have been installed into the BGP routing table. The bandwidth for each link is displayed with each route.

```

Router B# show ip bgp 192.168.1.0
BGP routing table entry for 192.168.1.0/24, version 48
Paths: (2 available, best #2)
Multipath: eBGP
  Advertised to update-groups:
    1          2
200
  172.16.1.1 from 172.16.1.2 (192.168.1.1)
    Origin incomplete, metric 0, localpref 100, valid, external, multipath, best
    Extended Community: 0x0:0:0
    DMZ-Link Bw 278 kbytes
200
  172.16.2.2 from 172.16.2.2 (192.168.1.1)
    Origin incomplete, metric 0, localpref 100, valid, external, multipath, best
    Extended Community: 0x0:0:0
    DMZ-Link Bw 625 kbytes

```

### Router A

In the following example, the **show ip bgp** command is entered on Router A to verify that the link bandwidth extended community has been propagated through the iBGP network to Router A. The output shows that a route for each exit link (on Router B and Router C) to autonomous system 200 has been installed as a best path in the BGP routing table.

```

Router A# show ip bgp 192.168.1.0
BGP routing table entry for 192.168.1.0/24, version 48
Paths: (3 available, best #3)
Multipath: eBGP
  Advertised to update-groups:
    1          2
200
  172.16.1.1 from 172.16.1.2 (192.168.1.1)
    Origin incomplete, metric 0, localpref 100, valid, external, multipath
    Extended Community: 0x0:0:0
    DMZ-Link Bw 278 kbytes
200
  172.16.2.2 from 172.16.2.2 (192.168.1.1)
    Origin incomplete, metric 0, localpref 100, valid, external, multipath, best
    Extended Community: 0x0:0:0
    DMZ-Link Bw 625 kbytes
200
  172.16.3.3 from 172.16.3.3 (192.168.1.1)
    Origin incomplete, metric 0, localpref 100, valid, external, multipath, best
    Extended Community: 0x0:0:0
    DMZ-Link Bw 2500 kbytes

```

## Router A

In the following example, the **show ip route** command is entered on Router A to verify the multipath routes that are advertised and the associated traffic share values:

```

Router A# show ip route 192.168.1.0
Routing entry for 192.168.1.0/24
  Known via "bgp 100", distance 200, metric 0
  Tag 200, type internal
  Last update from 172.168.1.1 00:01:43 ago
  Routing Descriptor Blocks:
  * 172.168.1.1, from 172.168.1.1, 00:01:43 ago
    Route metric is 0, traffic share count is 13
    AS Hops 1, BGP network version 0
    Route tag 200
  172.168.2.2, from 172.168.2.2, 00:01:43 ago
    Route metric is 0, traffic share count is 30
    AS Hops 1, BGP network version 0
    Route tag 200
  172.168.3.3, from 172.168.3.3, 00:01:43 ago
    Route metric is 0, traffic share count is 120
    AS Hops 1, BGP network version 0
    Route tag 200

```

# Additional References

The following sections provide references related to the BGP Link Bandwidth feature.

## Related Documents

Related Topic	Document Title
BGP commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	<i>Cisco IOS IP Routing: BGP Command Reference</i>

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"
iBGP multipath load sharing	"iBGP Multipath Load Sharing"
Cisco IOS master command list, all releases	<a href="#">Cisco IOS Master Command List, All Releases</a>

### 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

MIB	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: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a>

## Feature Information for BGP Link Bandwidth

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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

*Table 1: Feature Information for BGP Link Bandwidth*

Feature Name	Releases	Feature Information
BGP Link Bandwidth	Cisco IOS XE Release 2.1	<p>This feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following commands were added or modified by this feature: <b>bgp dmzlink-bw</b>, <b>neighbor dmzlink-bw</b>.</p>