Loadsharing IP Packets over More Than Six Parallel Paths

The Loadsharing IP Packets over More Than Six Parallel Paths feature increases the maximum number of parallel routes that can be installed to the routing table for multipath loadsharing.

Feature History for the Loadsharing IP Packets over More Than Six Parallel Paths Feature

Release	Modification
12.3(2)T	This feature was introduced.
12.2(25)S	This feature was integrated into Cisco IOS Release 12.2(25)S.
12.2(27)SBC	This feature was integrated into Cisco IOS Release 12.2(27)SBC.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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CISCO SYSTEMS

Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Restrictions for Loadsharing IP Packets over More Than Six Parallel Paths

The Loadsharing IP Packets Over More Than Six Parallel Paths feature is only available in software images for supported platforms in Cisco IOS Release 12.3(2)T and later 12.3T releases.

Loadsharing IP Packets over More Than Six Parallel Paths Overview

The Loadsharing IP Packets over More Than Six Parallel Paths feature increases the maximum number of parallel routes that can be installed to the routing table. The maximum number has been increased from six to sixteen for the following commands:

- **maximum-paths**
- **maximum-paths eibgp**
- **maximum-paths ibgp**

The output of the **show ip route summary** command has been updated to show the number of parallel routes supported by the routing table.

The benefits of this feature include the following:

- More flexible configuration of parallel routes in the routing table.
- Ability to configure multipath loadsharing over more links to allow for the configuration of higher-bandwidth aggregation using lower-speed links.

Additional References

For additional information related to multipath load sharing and the configuration of parallel routes, refer to the following references:

Related Documents

Related Topic	Document Title
Multipath Load Sharing and Routing	*Cisco IOS IP Configuration Guide*, Release 12.3 *Cisco IOS IP Command Reference*, *Volume 2 of 4: Routing Protocols*, Release 12.3
eiBGP Multipath Load Sharing	BGP Multipath Load Sharing for Both eBGP and iBGP in an MPLS VPN
iBGP Multipath Load Sharing	*iBGP Multipath Load Sharing*

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 obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

RFCs

RFCs[1]	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

1. Not all supported RFCs are listed.

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, tools, and lots more. Registered Cisco.com users can log in from this page to access even more content.	TAC Home Page: http://www.cisco.com/public/support/tac/home.shtml BGP Support Page: http://www.cisco.com/cgi-bin/Support/browse/psp_view.pl?p=Internetworking:BGP

Command Reference

This section documents modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.3 command reference publications.

- **maximum-paths**
- **maximum-paths eibgp**
- **maximum-paths ibgp**
- **show ip route summary**

maximum-paths

To control the maximum number of parallel routes an IP routing protocol can support, use the **maximum-paths** command in router configuration mode. To restore the default value, use the **no** form of this command.

maximum-paths {[*number-of-paths*] [**import** *number-of-paths*] | [**import** *number-of-paths*]}

no maximum-paths

Syntax Description

number-paths	Maximum number of parallel routes an IP routing protocol installs in the routing table. The range is from 1 to 16.
import *number-of paths*	(Optional) Specifies the number of paths that can be selected as multipaths for a VRF within a VPN. This keyword can only be configured under a VRF in address family configuration mode. **Note** We recommend that this feature is enabled only where needed and that the number of import paths be kept to the minimum (Typically, not more than two paths). For more information, see the related note in the usage guidelines of this command reference page.

Defaults

Border Gateway Protocol (BGP) by default will install only one best path into the routing table. The default for all other IP routing protocols is four paths.

Command Modes

Router configuration

Address-family configuration

Command History

Release	Modification
11.2	This command was introduced.
12.0(25)S	The **import** keyword was introduced.
12.3(2)T	The maximum number of parallel routes was increased from 6 to 16.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.

Usage Guidelines

The **maximum-paths** command is used to install parallel routes into the BGP routing table. The **maximum-paths** command cannot be configured with the **maximum-paths eibgp** command.

Configuring VRF Multipaths

A VRF will import only one path (the best path) per prefix from the source VRF table, unless the prefix is exported with a different route-target. If the best path goes down, the destination will not be reachable until the next import event occurs, and then a new best path will be imported into the VRF table. The import event runs every 15 seconds by default.

The **import** keyword allows the network operator to configure the VRF table to accept multiple redundant paths in addition to the best path. This feature should be used when there are multiple paths with identical next hops available to ensure optimal convergence times. A typical application of this configuration option is to configure redundant paths in a network that has multiple route reflectors for redundancy.

Note Configuring redundant paths with the **import** keyword can increase CPU and memory utilization significantly, especially in a network where there are many prefixes to learn and a large number of configured VRFs. It is recommended that this feature is only configured as necessary and that the minimum number of redundant paths are configured (Typically, not more than two).

Examples

The following example configuration installs 2 parallel routes in the BGP routing table:

```
Router(config)# router bgp 100
Router(config-router)# maximum-paths 2
Router(config-router)# end
```

The following example configuration installs 6 parallel routes in the BGP routing table and 2 parallel routes in the VRF table:

```
Router(config)# router bgp 100
Router(config-router)# address-family ipv4 vrf vrf-name
Router(config-router-af)# maximum-paths 6 import 2
Router(config-router-af)# end
```

The following example configuration installs 2 parallel routes in the VRF table:

```
Router(config)# router bgp 100
Router(config-router)# address-family ipv4 vrf vrf-name
Router(config-router-af)# maximum-paths import 2
Router(config-router-af)# end
```

maximum-paths eibgp

To configure multipath load sharing for external BGP (eBGP) and internal (iBGP) routes, use the **maximum-paths eibgp** command in address family configuration mode. To disable multipath load sharing for eBGP and iBGP routes, use the **no** form of this command.

maximum-paths eibgp *number* [**import** *number*]

no maximum-paths eibgp *number* [**import** *number*]

Syntax Description

number	Specifies the number of routes to install to the routing table. See the usage guidelines for the number of paths that can be configured with this argument.
import *number*	(Optional) Specifies the number of redundant paths that can be configured as back up multipaths for a VRF. This keyword can only be configured under a VRF in address family configuration mode. **Note** We recommend that this feature is enabled only where needed and that the number of import paths be kept to the minimum (Typically, not more than two paths). For more information, see the related note in the usage guidelines of this command reference page.

Defaults

Border Gateway Protocol (BGP) by default will install only one best path in the routing table.

Command Modes

IPv4 VRF Address family configuration

Command History

Release	Modification
12.2(4)T	This command was introduced.
12.0(24)S	This command was integrated into Cisco IOS Release 12.0(24)S.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.0(25)S	The **import** keyword was introduced.
12.2(13)T	The **import** keyword was integrated into Cisco IOS Release 12.2(13)T.
12.2(14)S	The **import** keyword was integrated into Cisco IOS Release 12.2(14)S.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.

Usage Guidelines

The **maximum-paths eibgp** command used to configure Border Gateway Protocol (BGP) multipath load sharing in an Multiprotocol Label Switching (MPLS) virtual private network (VPN) using eBGP and iBGP routes. This feature is configured under a VPN routing and forwarding instance (VRF) in address family configuration mode. The number of multipaths is configured separately for each VRF. The number of paths that can be configured is determined by the version of Cisco IOS software. The following list shows current limits:

- Cisco IOS Release 12.0S based software: 8 paths
- Cisco IOS Release 12.3T based software: 16 paths

- Cisco IOS Release 12.2S based software: 32 paths

The **maximum-paths eibgp** command cannot be configured with the **maximum-paths** or **maximum-paths ibgp** command because the **maximum-paths eibgp** command is a superset of these commands.

Note The configuration of this command does not override the existing outbound routing policy.

Configuring VRF Import Paths

A VRF will import only one path (best path) per prefix from the source VRF table, unless the prefix is exported with a different route-target. If the best path goes down, the destination will not be reachable until the next import event occurs, and then a new best path will be imported into the VRF table. The import event runs every 15 seconds by default.

The **import** keyword allows you to configure the VRF table to accept multiple redundant paths in addition to the best path. An import path is a redundant path, and it can have a next hop that matches an installed multipath.This feature should be used when there are multiple paths with identical next hops available to ensure optimal convergence times. A typical application of this feature is to configure redundant paths in a network that has multiple route reflectors for redundancy.

Note Configuring redundant paths with the **import** keyword can increase CPU and memory utilization significantly, especially in a network where there are many prefixes to learn and a large number of configured VRFs. It is recommended that this feature is only configured as necessary and that the minimum number of redundant paths are configured (Typically, not more than two).

Examples

In the following example, the router is configured to install 6 eBGP or iBGP routes into the VRF routing table:

```
Router(config)# router bgp 40000
Router(config-router)# address-family ipv4 vrf YELLOW
Router(config-router-af)# maximum-paths eibgp 6
```

In the following example, the router is configured to install 4 equal-cost routes and 2 import routes (backup) in the VRF routing table:

```
Router(config)# router bgp 45000
Router(config-router)# address-family ipv4 vrf GREEN
Router(config-router-af)# maximum-paths eibgp 4 import 2
```

In the following example, the router is configured to install 2 import routes in the VRF routing table:

```
Router(config)# router bgp 50000
Router(config-router)# address-family ipv4 vrf ORANGE
Router(config-router-af)# maximum-paths eibgp import 2
```

Note Separate VRFs must be configured with different route distinguisher to support separate multipath configurations.

Related Commands

Command	Description
maximum-paths	Configures the number of equal-cost routes that BGP will install in the routing table.
maximum-paths ibgp	Configures the number of equal-cost or unequal-cost routes that BGP will install in the routing table.
show ip bgp	Displays entries in the BGP routing table.

maximum-paths ibgp

To control the maximum number of parallel internal Border Gateway Protocol (iBGP) routes that can be installed in a routing table, use the **maximum-paths ibgp** command in router configuration mode. To restore the default value, use the **no** form of this command.

maximum-paths ibgp {[*number*] [**import** *number*] | [**import** *number*]}

no maximum-paths ibgp

Syntax Description

number	Specifies the number of routes to install to the routing table. See the usage guidelines for the number of paths that can be configured with this argument.
import *number*	(Optional) Specifies the number of redundant paths that can be configured as back up multipaths for a VRF. This keyword can only be configured under a VRF in address family configuration mode. **Note** We recommend that this feature is enabled only where needed and that the number of import paths be kept to the minimum (Typically, not more than two paths). For more information, see the related note in the usage guidelines of this command reference page.

Defaults

BGP, by default, will install only one best path in the routing table.

Command Modes

Address-family configuration
Router configuration

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(25)S	The **import** keyword was introduced in Cisco IOS Release 12.0(25)S.
12.3	The **import** keyword was integrated into Cisco IOS Release 12.3.
12.3(2)T	The maximum number of parallel routes was increased from 6 to 16.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S for use in IPv6.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.

Usage Guidelines

iBGP Multipath Load Sharing

The iBGP Multipath Load Sharing feature is enabled when the following conditions are met:

- The **maximum-paths ibgp** command must be set to a value greater than one.
- 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, a BGP-speaking router will still designate one of the multipaths as the best path and advertise this best path to its neighbors.

The number of paths that can be configured is determined by the version of Cisco IOS software. The following list shows current limits:

- Cisco IOS Release 12.0S-based software: 8 paths
- Cisco IOS Release 12.3T-based software: 16 paths
- Cisco IOS Release 12.2S-based software: 32 paths

Note In IPv6, the **maximum-paths ibgp** command does not work for prefixes learned from iBGP neighbors that have been configured with the **send-label** keyword. If multiple routes exist for such prefixes, all of them are inserted into the RIB when the **maximum-paths ibgp** command is configured, but only one is used and no load balancing occurs between equal-cost paths.
The **maximum-paths ibgp** command works with 6PE only in Cisco IOS Release 12.2(25)S and subsequent 12.2S releases.

Configuring VRF Multipaths

A VRF will import only one path (the best path) per prefix from the source VRF table, unless the prefix is exported with a different route-target. If the best path goes down, the destination will not be reachable until the next import event occurs, and then a new best path will be imported into the VRF table. The import event runs every 15 seconds by default.

The **import** keyword allows the network operator to configure the VRF table to accept multiple redundant paths in addition to the best path. This feature should be used when there are multiple paths with identical next hops available to ensure optimal convergence times. A typical application of this configuration option is to configure redundant paths in a network that has multiple route reflectors for redundancy.

Note Configuring redundant paths with the **import** keyword can increase CPU and memory utilization significantly, especially in a network where there are many prefixes to learn and a large number of configured VRFs. It is recommended that this feature is only configured as necessary and that the minimum number of redundant paths are configured (Typically, not more than two).

Examples

The following example configuration installs 3 parallel iBGP paths in a non-Multiprotocol Label Switching (MPLS) topology:

```
Router(config)# router bgp 100
Router(config-router)# maximum-paths ibgp 3
```

The following example configuration installs 3 parallel iBGP paths in an MPLS Virtual Private Network (VPN) topology:

```
Router(config)# router bgp 100
Router(config-router)# address-family ipv4 unicast vrf RED
Router(config-route-af)# maximum-paths ibgp 3
```

The following example configuration installs 2 parallel routes in the VRF table:

```
Router(config)# router bgp 100
Router(config-router)# address-family ipv4 vrf BLUE
Router(config-router-af)# maximum-paths ibgp 2 import 2
```

```
Router(config-router-af)# end
```

The following example configuration installs 2 parallel routes in the VRF table:

```
Router(config)# router bgp 100
Router(config-router)# address-family ipv4 vrf GREEN
Router(config-router-af)# maximum-paths ibgp import 2
Router(config-router-af)# end
```

Related Commands

Command	Description
maximum-paths	Controls the maximum number of parallel routes an IP routing protocol can support.

show ip route summary

To display the current state of the routing table, use the **show ip route summary** command in EXEC mode.

show ip route summary

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.3(2)T	The number of multipaths supported by the routing table was added to the output.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.

Examples

The following is sample output from the **show ip route summary** command:

```
Router# show ip route summary

IP routing table name is Default-IP-Routing-Table(0)
IP routing table maximum-paths is 16
Route Source    Networks    Subnets     Overhead    Memory (bytes)
connected       0           3           126         360
static          1           2           126         360
eigrp 109       747         12          31878       91080
internal        3                                   360
Total           751         17          32130       92160
```

Table 1 describes the significant fields shown in the display.

Table 1 show ip route summary Field Descriptions

Field	Description
IP routing table name is...	Displays routing table type and table ID.
IP routing table maximum-paths is...	Number of parallel routes supported by this routing table.
Route Source	Routing protocol name, or the **connected, static,** or **internal** keyword. “Internal” indicates those routes that are in the routing table that are not owned by any routing protocol.
Networks	Number of prefixes that are present in the routing table for each route source.
Subnets	Number of subnets that are present in the routing table for each route source, including host routes.

Table 1 show ip route summary Field Descriptions (continued)

Field	Description
Overhead	Any additional memory involved in allocating the routes for the particular route source other than the memory specified in the Memory field.
Memory	Number of bytes allocated to maintain all the routes for the particular route source.