Configuring Route Maps to Control the Distribution of MPLS Labels Between Routers in an MPLS VPN

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Route maps enable you to specify which routes are distributed with Multiprotocol Label Switching (MPLS) labels. Route maps also enable you to specify which routes with MPLS labels a router receives and adds to its Border Gateway Protocol (BGP) table.

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 Using Route Maps with MPLS VPNs

You can use route maps with MPLS VPN Inter-AS with Autonomous System Boundary Routers (ASBRs) exchanging IPv4 routes with MPLS labels. You cannot use route maps with MPLS VPN Inter-AS with ASBRs exchanging VPN-IPv4 addresses.

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Prerequisites for Using Route Maps with MPLS VPNs

Before you configure and apply route maps, you need to create an access control list (ACL) and specify the routes that the router should distribute with MPLS labels.

Information About Route Maps in MPLS VPNs

When routers are configured to distribute routes with MPLS labels, all the routes are encoded with the multiprotocol extensions and contain MPLS labels. You can use a route map to control the distribution of MPLS labels between routers.

Route maps enable you to specify which routes are distributed with MPLS labels. Route maps also enable you to specify which routes with MPLS labels a router receives and adds to its BGP table. Route maps enable you to specify the following:

- For a router distributing MPLS labels, you can specify which routes are distributed with an MPLS label.
- For a router receiving MPLS labels, you can specify which routes are accepted and installed in the BGP table.

Route maps work with ACLs. You enter the routes into an ACL and then specify the ACL when you configure the route map. You can configure a router to accept only routes that are specified in the route map. The router checks the routes listed in the BGP update message against the list of routes in the specified ACL. If a route in the BGP update message matches a route in the ACL, the route is accepted and added to the BGP table.

How to Configure Route Maps in an MPLS VPN

Perform the following tasks to enable routers to send MPLS labels with the routes specified in the route maps:

- Configuring a Route Map for Incoming Routes, page 2
- Configuring a Route Map for Outgoing Routes, page 4
- Applying the Route Maps to the MPLS VPN Edge Routers, page 6

Configuring a Route Map for Incoming Routes

Perform this task to create a route map to filter arriving routes. You create an ACL and specify the routes that the router should accept and add to the BGP table.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *as-number*
4. **route-map** *map-name* [**permit** | **deny**] *sequence-number*
5. **match ip address** {*access-list-number* [*access-list-number...*| *access-list-name...*] *access-list-name* [*access-list-number...*| *access-list-name*] | **prefix-list** *prefix-list-name* [*prefix-list-name....*]]
6. **match mpls-label**
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *as-number* **Example:** `Router(config)# router bgp 100`	Configures a BGP routing process and enters router configuration mode. • The *as-number* argument indicates the number of an autonomous system that identifies the router to other BGP routers and tags the routing information passed along. Valid numbers are from 0 to 65535. Private autonomous system numbers that can be used in internal networks range from 64512 to 65535.
Step 4	**route-map** *map-name* [**permit**	**deny**] *sequence-number* **Example:** `Router(config-router)# route-map csc-mpls-routes-in permit`	Enters route map configuration mode and creates a route map with the name you specify. • The *map-name* argument identifies the name of the route map. • The **permit** keyword allows the actions to happen if all conditions are met. • A **deny** keyword prevents any actions from happening if all conditions are met. • The *sequence-number* argument allows you to prioritize route maps. If you have multiple route maps and want to prioritize them, assign each one a number. The route map with the lowest number is implemented first, followed by the route map with the second lowest number, and so on.

	Command or Action	Purpose
Step 5	**match ip address** {*access-list-number* [*access-list-number...*| *access-list-name...*] *access-list-name* [*access-list-number...*| *access-list-name*]	**prefix-list** *prefix-list-name* [*prefix-list-name....*]] **Example:** `Router(config-route-map)# match ip address acl-in`	Distributes any routes that have a destination network number address that is permitted by a standard access list, an extended access list, or a prefix list, or performs policy routing on packets. • The *access-list-number...* argument is a number of a standard or extended access list. It can be an integer from 1 to 199. The ellipsis indicates that multiple values can be entered. • The *access-list-name...* argument is a name of a standard or extended access list. It can be an integer from 1 to 199. The ellipsis indicates that multiple values can be entered. • The **prefix-list** keyword distributes routes based on a prefix list. • The *prefix-list-name...* argument is a name of a specific prefix list. The ellipsis indicates that multiple values can be entered.
Step 6	**match mpls-label** **Example:** `Router(config-route-map)# match mpls-label`	Redistributes routes that include MPLS labels if the routes meet the conditions specified in the route map.
Step 7	**exit** **Example:** `Router(config-route-map)# exit`	Exits route map configuration mode and returns to global configuration mode.

Configuring a Route Map for Outgoing Routes

This configuration is optional.

Perform this task to create a route map to filter departing routes. You create an access list and specify the routes that the router should distribute with MPLS labels.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *as-number*
4. **route-map** *map-name* [**permit** | **deny**] *sequence-number*
5. **match ip address** {*access-list-number* [*access-list-number...*| *access-list-name...*}] | *access-list-name* [*access-list-number...*| *access-list-name* | **prefix-list** *prefix-list-name* [*prefix-list-name....*]]
6. **set mpls-label**
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *as-number* **Example:** `Router(config)# router bgp 100`	Configures a BGP routing process and enters router configuration mode. • The *as-number* argument indicates the number of an autonomous system that identifies the router to other BGP routers and tags the routing information passed along. Valid numbers are from 0 to 65535. Private autonomous system numbers that can be used in internal networks range from 64512 to 65535.
Step 4	**route-map** *map-name* [**permit** | **deny**] *sequence-number* **Example:** `Router(config-router)# route-map csc-mpls-routes-out permit`	Enters route map configuration mode and creates a route map with the name you specify. • The *map-name* argument identifies the name of the route map. • The **permit** keyword allows the actions to happen if all conditions are met. • A **deny** keyword prevents any actions from happening if all conditions are met. • The *sequence-number* argument allows you to prioritize route maps. If you have multiple route maps and want to prioritize them, assign each one a number. The route map with the lowest number is implemented first, followed by the route map with the second lowest number, and so on.
Step 5	**match ip address** {*access-list-number* [*access-list-number...*| *access-list-name...*}] | *access-list-name* [*access-list-number...*| *access-list-name* | **prefix-list** *prefix-list-name* [*prefix-list-name....*]] **Example:** `Router(config-route-map)# match ip address acl-out`	Distributes any routes that have a destination network number address that is permitted by a standard access list, an extended access list, or a prefix list, or performs policy routing on packets. • The *access-list-number...* argument is a number of a standard or extended access list. It can be an integer from 1 to 199. The ellipsis indicates that multiple values can be entered. • The *access-list-name...* argument is a name of a standard or extended access list. It can be an integer from 1 to 199. The ellipsis indicates that multiple values can be entered. • The **prefix-list** keyword distributes routes based on a prefix list. • The *prefix-list-name...* argument is a name of a specific prefix list. The ellipsis indicates that multiple values can be entered.

	Command or Action	Purpose
Step 6	**set mpls-label** **Example:** `Router(config-route-map)# set mpls-label`	Enables a route to be distributed with an MPLS label if the route matches the conditions specified in the route map.
Step 7	**exit** **Example:** `Router(config-route-map)# exit`	Exits route map configuration mode and returns to global configuration mode.

Applying the Route Maps to the MPLS VPN Edge Routers

This configuration is optional.

Perform this task to enable the edge routers to use the route maps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *as-number*
4. **address-family ipv4** [**multicast** | **unicast** | **vrf** *vrf-name*]
5. **neighbor** *ip-address* **route-map** *map-name* **in**
6. **neighbor** *ip-address* **route-map** *map-name* **out**
7. **neighbor** *ip-address* **send-label**
8. **exit-address-family**
9. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *as-number* **Example:** `Router(config)# router bgp 100`	Configures a BGP routing process and enters router configuration mode. • The *as-number* argument indicates the number of an autonomous system that identifies the router to other BGP routers and tags the routing information passed along. Valid numbers are from 0 to 65535. Private autonomous system numbers that can be used in internal networks range from 64512 to 65535.
Step 4	**address-family ipv4** [**multicast** | **unicast** | **vrf** *vrf-name*] **Example:** `Router(config-router)# address-family ipv4 vrf vpn1`	Specifies the IPv4 address family type and enters address family configuration mode. • The **multicast** keyword specifies IPv4 multicast address prefixes. • The **unicast** keyword specifies IPv4 unicast address prefixes. • The **vrf** *vrf-name* keyword and argument specify the name of the VRF to associate with subsequent IPv4 address family configuration mode commands.
Step 5	**neighbor** *ip-address* **route-map** *map-name* **in** **Example:** `Router(config-router-af)# neighbor pp. 0.0.1 route-map csc-mpls-routes-in in`	Applies a route map to incoming routes. • The *ip-address* argument specifies the router to which the route map is to be applied. • The *map-name* argument specifies the name of the route map. • The **in** keyword applies the route map to incoming routes.
Step 6	**neighbor** *ip-address* **route-map** *map-name* **out** **Example:** `Router(config-router-af)# neighbor pp. 0.0.1 route-map csc-mpls-route-out out`	Applies a route map to outgoing routes. • The *ip-address* argument specifies the router to which the route map is to be applied. • The *map-name* argument specifies the name of the route map. • The **out** keyword applies the route map to outgoing routes.
Step 7	**neighbor** *ip-address* **send-label** **Example:** `Router(config-router-af)# neighbor pp. 0.0.1 send-label`	Enables a BGP router to send MPLS labels with BGP routes to a neighboring BGP router. • The *ip-address* argument specifies the IP address of the neighboring router.

	Command or Action	Purpose
Step 8	**exit-address-family** **Example:** `Router(config-router-af)# exit-address-family`	Exits from address family configuration mode.
Step 9	**end** **Example:** `Router(config-router)# end`	(Optional) Exits to privileged EXEC mode.

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Troubleshooting Tips

You can enter a **show route-map** *map-name* command to verify that the route map is applied to the PE routers.

Note After you make any changes to a route map, you need to reset the BGP connection for the changes to take effect.

Configuration Examples for Route Maps in MPLS VPNs

Using a Route Map in an MPLS VPN Inter-AS Network Example

In this example, a route map is applied to an autonomous system border router (ASBR) that exchanges IPv4 routes and MPLS labels with another ASBR.

- A route map called OUT specifies that the ASBR should distribute the PE1 route (ee.ee) with labels and the RR1 route (aa.aa) without labels.
- A route map called IN specifies that the ASBR should accept the PE2 route (ff.ff) with labels and the RR2 route (bb.bb) without labels.

```
ip subnet-zero
mpls label protocol tdp
!
interface Loopback0
 ip address ww.ww.ww.ww 255.255.255.255
 no ip directed-broadcast
 no ip route-cache
```

```
 no ip mroute-cache
!
interface Ethernet0/2
 ip address hh.0.0.2 255.0.0.0
 no ip directed-broadcast
 no ip mroute-cache
!
interface Ethernet0/3
 ip address dd.0.0.1 255.0.0.0
 no ip directed-broadcast
 no ip mroute-cache
 mpls label protocol ldp
 tag-switching ip
!
router ospf 10
 log-adjacency-changes
 auto-cost reference-bandwidth 1000
 redistribute connected subnets
 passive-interface Ethernet0/2
 network ww.ww.ww.ww 0.0.0.0 area 100
 network dd.0.0.0 0.255.255.255 area 100

router bgp 100
 bgp log-neighbor-changes
 timers bgp 10 30
 neighbor aa.aa.aa.aa remote-as 100
 neighbor aa.aa.aa.aa update-source Loopback0
 neighbor hh.0.0.1 remote-as 200
 no auto-summary
 !
!
address-family ipv4                      ! Redistributing IGP into BGP
 redistribute ospf 10                    ! so that PE1 & RR1 loopbacks
 neighbor aa.aa.aa.aa activate           ! get into the BGP table
 neighbor aa.aa.aa.aa send-label
 neighbor hh.0.0.1 activate
 neighbor hh.0.0.1 advertisement-interval 5
 neighbor hh.0.0.1 send-label
 neighbor hh.0.0.1 route-map IN in       ! accepting routes in route map IN.
 neighbor hh.0.0.1 route-map OUT out     ! distributing routes in route map OUT.
 neighbor kk.0.0.1 activate
 neighbor kk.0.0.1 advertisement-interval 5
 neighbor kk.0.0.1 send-label
 neighbor kk.0.0.1 route-map IN in       ! accepting routes in route map IN.
 neighbor kk.0.0.1 route-map OUT out     ! distributing routes in route map OUT.
 no auto-summary
 no synchronization
 exit-address-family
!
ip default-gateway 3.3.0.1
ip classless
!
access-list 1 permit ee.ee.ee.ee log               !Setting up the access lists
access-list 2 permit ff.ff.ff.ff log
access-list 3 permit aa.aa.aa.aa log
access-list 4 permit bb.bb.bb.bb log
route-map IN permit 10                             !Setting up the route maps
 match ip address 2
 match mpls-label
!
route-map IN permit 11
 match ip address 4
!
route-map OUT permit 12
 match ip address 3
!
route-map OUT permit 13
 match ip address 1
 set mpls-label
!
end
```

Using a Route Map in an MPLS VPN CSC Network Example

The following example creates two route maps, which are named:

- IN for incoming routes
- OUT for outgoing routes

The route maps specify the following:

- If an IP address in an incoming BGP update message matches an IP address in access list 99, the route is added to the BGP table.
- If an IP address in an outbound BGP update message matches an IP address in access list 88, the router distributes that route.

The route maps are applied to the CSC-PE router with the address qq.0.0.1.

```
address-family ipv4 vrf vpn2
 neighbor qq.0.0.1 remote-as 200
 neighbor qq.0.0.1 activate
 neighbor qq.0.0.1 as-override
 neighbor qq.0.0.1 advertisement-interval 5
 neighbor qq.0.0.1 route-map IN in
 neighbor qq.0.0.1 route-map OUT out
 neighbor qq.0.0.1 send-label
!
access-list 88 permit rr.rr.rr.rr
access-list 88 permit ss.ss.ss.ss
access-list 88 permit tt.tt.tt.tt
access-list 99 permit uu.uu.uu.uu
access-list 99 permit vv.vv.vv.vv
access-list 99 permit ww.ww.ww.ww
!
route-map IN permit 1
 match ip address 99
!
route-map OUT permit 1
 match ip address 88
 set mpls-label
!
```

Additional References

Related Documents

Related Topic	Document Title
Basic MPLS VPNs	Configuring MPLS Layer 3 VPNs
MPLS VPN Carrier Supporting Carrier	• MPLS VPN Carrier Supporting Carrier Using LDP and an IGP • MPLS VPN Carrier Supporting Carrier with BGP

Related Topic	Document Title
MPLS VPN InterAutonomous Systems	• MPLS VPN Inter-AS with ASBRs Exchanging IPv4 Routes and MPLS Labels • MPLS VPN Inter-AS with ASBRs Exchanging VPN-IPv4 Addresses

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 software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2547	BGP/MPLS VPNs

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	
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.	

Feature Information for Route Maps in MPLS VPNs

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 Route Maps in MPLS VPNs

Feature Name	Releases	Feature Configuration Information
This feature was included as part of the following features: • MPLS VPN Inter-Autonomous Systems - IPv4 BGP Label Distribution • MPLS VPN Carrier Supporting Carrier with IPv4 BGP Label Distribution	12.0(21)ST 12.0(22)S 12.0(23)S 12.2(13)T 12.0(24)S 12.2(14)S 12.0(27)S 12.0(29)S	Route maps enable you to specify which routes are distributed with MPLS labels. Route maps also enable you to specify which routes with MPLS labels a router receives and adds to its BGP table.