



Implementing RIP for IPv6

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This module describes how to configure Routing Information Protocol for IPv6. RIP is a distance-vector routing protocol that uses hop count as a routing metric. RIP is an Interior Gateway Protocol (IGP) most commonly used in smaller networks.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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.

Information About Implementing RIP for IPv6

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RIP for IPv6

IPv6 RIP functions the same and offers the same benefits as RIP in IPv4. RIP enhancements for IPv6, detailed in RFC 2080, include support for IPv6 addresses and prefixes, and the use of the all-RIP-devices multicast group address FF02::9 as the destination address for RIP update messages.



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In the Cisco software implementation of IPv6 RIP, each IPv6 RIP process maintains a local routing table, referred to as a Routing Information Database (RIB). The IPv6 RIP RIB contains a set of best-cost IPv6 RIP routes learned from all its neighboring networking devices. If IPv6 RIP learns the same route from two different neighbors, but with different costs, it will store only the lowest cost route in the local RIB. The RIB also stores any expired routes that the RIP process is advertising to its neighbors running RIP. IPv6 RIP will try to insert every non-expired route from its local RIB into the master IPv6 RIB. If the same route has been learned from a different routing protocol with a better administrative distance than IPv6 RIP, the RIP route will not be added to the IPv6 RIB but the RIP route will still exist in the IPv6 RIP RIB.

Nonstop Forwarding for IPv6 RIP

Cisco nonstop forwarding (NSF) continues forwarding packets while routing protocols converge, therefore avoiding a route flap on switchover. When an RP failover occurs, the Forwarding Information Base (FIB) marks installed paths as stale by setting a new epoch. Subsequently, the routing protocols reconverge and populate the RIB and FIB. Once all NSF routing protocols converge, any stale routes held in the FIB are removed. A failsafe timer is required to delete stale routes, in case of routing protocol failure to repopulate the RIB and FIB.

RIP registers as an IPv6 NSF client. Doing so has the benefit of using RIP routes installed in the Cisco Express Forwarding table until RIP has converged on the standby.

How to Implement RIP for IPv6

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Enabling IPv6 RIP

Before configuring the router to run IPv6 RIP, globally enable IPv6 using the **ipv6 unicast-routing** command in global configuration mode, and enable IPv6 on any interfaces on which IPv6 RIP is to be enabled.

If you want to set or change a global value, follow steps 1 and 2, and then use the optional **ipv6 router rip** command in global configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 unicast-routing**
4. **interface type number**
5. **ipv6 rip name enable**

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	ipv6 unicast-routing Example: Router(config)# ipv6 unicast-routing	Enables the forwarding of IPv6 unicast datagrams.
Step 4	interface <i>type number</i> Example: Router(config)# interface gigabitethernet 0/0/0	Specifies the interface type and number, and enters interface configuration mode.
Step 5	ipv6 rip <i>name</i> enable Example: Router(config-if)# ipv6 rip process1 enable	Enables the specified IPv6 RIP routing process on an interface.

Customizing IPv6 RIP

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 router rip** *word*
4. **maximum-paths** *number-paths*
5. **exit**
6. **interface** *type number*
7. **ipv6 rip** *name* **default-information** {**only** | **originate**} [**metric** *metric-value*]

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 ipv6 router rip word Example: Router(config)# ipv6 router rip process1	Configures an IPv6 RIP routing process and enters router configuration mode for the IPv6 RIP routing process. Use the <i>word</i> argument to identify a specific IPv6 RIP routing process.
Step 4 maximum-paths number-paths Example: Router(config-router)# maximum-paths 1	(Optional) Defines the maximum number of equal-cost routes that IPv6 RIP can support. The <i>number-paths</i> argument is an integer from 1 to 64. The default for RIP is four paths.
Step 5 exit Example: Router(config-if)# exit	Exits interface configuration mode and enters global configuration mode.
Step 6 interface type number Example: Router(config)# interface gigabitethernet 0/0/0	Specifies the interface type and number, and enters interface configuration mode.

Command or Action	Purpose
Step 7 <code>ipv6 rip name default-information {only originate} [metric metric-value]</code> Example: <pre>Router(config-if)# ipv6 rip process1 default-information originate</pre>	(Optional) Originates the IPv6 default route (::/0) into the specified RIP routing process updates sent out of the specified interface. Note To avoid routing loops after the IPv6 default route (::/0) is originated out of any interface, the routing process ignores all default routes received on any interface. - Specifying the only keyword originates the default route (::/0) but suppresses all other routes in the updates sent on this interface. - Specifying the originate keyword originates the default route (::/0) in addition to all other routes in the updates sent on this interface.

Redistributing Routes into an IPv6 RIP Routing Process

The maximum metric that RIP can advertise is 16, and a metric of 16 denotes a route that is unreachable. Therefore, if you are redistributing routes with metrics greater than or equal to 16, then by default RIP will advertise them as unreachable. These routes will not be used by neighboring routers. The user must configure a redistribution metric of less than 15 for these routes.



Note

You must to advertise a route with metric of 15 or less. A RIP router always adds an interface cost--the default is 1--onto the metric of a received route. If you advertise a route with metric 15, your neighbor will add 1 to it, making a metric of 16. Because a metric of 16 is unreachable, your neighbor will not install the route in the routing table.

If no metric is specified, then the current metric of the route is used. To find the current metric of the route, enter the **show ipv6 route** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface type number**
4. **ipv6 rip word enable**
5. **redistribute protocol [process-id] {level-1 | level-1-2 | level-2} [metric metric-value] [metric-type {internal | external}] [route-map map-name]**

DETAILED STEPS

Command or Action	Purpose
Step 1 <code>enable</code> Example: <pre>Router> enable</pre>	Enables privileged EXEC mode. Enter your password if prompted.

Command or Action	Purpose
Step 2 <code>configure terminal</code> Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3 <code>interface type number</code> Example: <pre>Router(config)# interface gigabitethernet 0/0/0</pre>	Specifies the interface type and number, and enters interface configuration mode.
Step 4 <code>ipv6 rip word enable</code> Example: <pre>Router(config-if)# ipv6 router one enable</pre>	Enables an IPv6 Routing Information Protocol (RIP) routing process on an interface.
Step 5 <code>redistribute protocol [process-id] {level-1 level-1-2 level-2} [metric metric-value] [metric-type {internal external}] [route-map map-name]</code> Example: <pre>Router(config-router)# redistribute bgp 65001 route-map bgp-to-rip</pre>	Redistributes the specified routes into the IPv6 RIP routing process. - The <i>protocol</i> argument can be one of the following keywords: bgp, connected, isis, rip, or static. - The rip keyword and <i>process-id</i> argument specify an IPv6 RIP routing process. Note The connected keyword refers to routes that are established automatically by assigning IPv6 addresses to an interface.

Configuring Route Tags for IPv6 RIP Routes

When performing route redistribution, you can associate a numeric tag with a route. The tag is advertised with the route by RIP and will be installed along with the route in neighboring router's routing table.

If you redistribute a tagged route (for example, a route in the IPv6 routing table that already has a tag) into RIP, then RIP will automatically advertise the tag with the route. If you use a redistribution route map to specify a tag, then RIP will use the route map tag in preference to the routing table tag.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **route-map map-tag [permit | deny] [sequence-number]**
4. **match ipv6 address {prefix-list prefix-list-name | access-list-name}**
5. **set tag tag-value**

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	route-map <i>map-tag</i> [permit deny] [<i>sequence-number</i>] Example: Router(config)# route-map bgp-to-rip permit 10	Defines a route map, and enters route-map configuration mode. Follow this step with a match command.
Step 4	match ipv6 address { prefix-list <i>prefix-list-name</i> <i>access-list-name</i> } Example: Router(config-route-map)# match ipv6 address prefix-list bgp-to-rip-flt	Specifies a list of IPv6 prefixes to be matched.
Step 5	set tag <i>tag-value</i> Example: Router(config-route-map)# set tag 4	Sets the tag value to associate with the redistributed routes.

Filtering IPv6 RIP Routing Updates

Route filtering using distribute lists provides control over the routes RIP receives and advertises. This control may be exercised globally or per interface.

Filtering is controlled by distribute lists. Input distribute lists control route reception, and input filtering is applied to advertisements received from neighbors. Only those routes that pass input filtering will be inserted in the RIP local routing table and become candidates for insertion into the IPv6 routing table.

Output distribute lists control route advertisement; Output filtering is applied to route advertisements sent to neighbors. Only those routes passing output filtering will be advertised.

Global distribute lists (which are distribute lists that do not apply to a specified interface) apply to all interfaces. If a distribute list specifies an interface, then that distribute list applies only to that interface.

An interface distribute list always takes precedence. For example, for a route received at an interface, with the interface filter set to deny, and the global filter set to permit, the route is blocked, the interface filter is passed, the global filter is blocked, and the route is passed.

IPv6 prefix lists are used to specify certain prefixes or a range of prefixes that must be matched before a permit or deny statement can be applied. Two operand keywords can be used to designate a range of prefix lengths to be matched. A prefix length of less than, or equal to, a value is configured with the **le** keyword. A prefix length greater than, or equal to, a value is specified using the **ge** keyword. The **ge** and **le** keywords can be used to specify the range of the prefix length to be matched in more detail than the usual *ipv6-prefix / prefix-length* argument. For a candidate prefix to match against a prefix list entry three conditions can exist:

- The candidate prefix must match the specified prefix list and prefix length entry.
- The value of the optional **le** keyword specifies the range of allowed prefix lengths from the *prefix-length* argument up to, and including, the value of the **le** keyword.
- The value of the optional **ge** keyword specifies the range of allowed prefix lengths from the value of the **ge** keyword up to, and including, 128.

**Note**

Note that the first condition must match before the other conditions take effect.

An exact match is assumed when the **ge** or **le** keywords are not specified. If only one keyword operand is specified then the condition for that keyword is applied, and the other condition is not applied. The *prefix-length* value must be less than the **ge** value. The **ge** value must be less than, or equal to, the **le** value. The **le** value must be less than or equal to 128.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ipv6 prefix list** *prefix-list-name seq seq-number*] { **deny** *ipv6-prefix/prefix-length* | **description** *text* } [**ge** *ge-value*] [**le** *le-value*]
4. **ipv6 prefix list** *prefix-list-name seq seq-number*] { **deny** *ipv6-prefix/prefix-length* | **description** *text* } [**ge** *ge-value*] [**le** *le-value*]
5. Repeat Steps 3 and 4 as many times as necessary to build the prefix list.
6. **ipv6 router rip** *name*
7. **distribute-list prefix-list** *prefix-list-name in | out* } [*interface-type interface-number*]

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	ipv6 prefix list <i>prefix-list-name seq seq-number</i> [deny <i>ipv6-prefix/prefix-length</i> description <i>text</i>] [ge <i>ge-value</i>] [le <i>le-value</i>] Example: Router(config)# ipv6 prefix-list abc permit 2001:DB8::/16	Creates an entry in the IPv6 prefix list.
Step 4	ipv6 prefix list <i>prefix-list-name seq seq-number</i> [deny <i>ipv6-prefix/prefix-length</i> description <i>text</i>] [ge <i>ge-value</i>] [le <i>le-value</i>] Example: Router(config)# ipv6 prefix-list abc deny ::/0	Creates an entry in the IPv6 prefix list.
Step 5	Repeat Steps 3 and 4 as many times as necessary to build the prefix list.	--
Step 6	ipv6 router rip <i>name</i> Example: Router(config)# ipv6 router rip process1	Configures an IPv6 RIP routing process.
Step 7	distribute-list prefix-list <i>prefix-list-name in out</i> [<i>interface-type interface-number</i>] Example: Router(config-rtr-rip)# distribute-list prefix-list process1 in gigabitethernet 0/0/0	Applies a prefix list to IPv6 RIP routing updates that are received or sent on an interface.

Verifying IPv6 RIP Configuration and Operation

SUMMARY STEPS

1. **show ipv6 rip** [*name*][**database** | **next-hops**]
2. **show ipv6 route** [*ipv6-address* | *ipv6-prefix/prefix-length*] *protocol* | *interface-type interface-number*]
3. **enable**
4. **debug ipv6 rip** [*interface-type interface-number*]

DETAILED STEPS

Command or Action	Purpose
Step 1 <code>show ipv6 rip</code> [<i>name</i>][<i>database</i> next-hops] Example: Router> show ipv6 rip process1 database	(Optional) Displays information about current IPv6 RIP processes. In this example, IPv6 RIP process database information is displayed for the specified IPv6 RIP process.
Step 2 <code>show ipv6 route</code> [<i>ipv6-address</i> <i>ipv6-prefix/prefix-length</i> <i>protocol</i> <i>interface-type interface-number</i>] Example: Router> show ipv6 route rip	(Optional) Displays the current contents of the IPv6 routing table. In this example, only IPv6 RIP routes are displayed.
Step 3 <code>enable</code> Example: Router> enable	Enables higher privilege levels, such as privileged EXEC mode. Enter your password if prompted.
Step 4 <code>debug ipv6 rip</code> [<i>interface-type interface-number</i>] Example: Router# debug ipv6 rip	(Optional) Displays debugging messages for IPv6 RIP routing transactions.

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Examples

- [Sample Output for the show ipv6 rip Command, page 10](#)
- [Sample Output for the show ipv6 route Command, page 11](#)
- [Sample Output for the debug ipv6 rip Command, page 11](#)

Sample Output for the show ipv6 rip Command

In the following example, output information about all current IPv6 RIP processes is displayed using the `show ipv6 rip` command:

```
Router> show ipv6 rip
RIP process "process1", port 521, multicast-group FF02::9, pid 62
  Administrative distance is 120. Maximum paths is 1
  Updates every 5 seconds, expire after 15
  Holddown lasts 10 seconds, garbage collect after 30
  Split horizon is on; poison reverse is off
  Default routes are generated
  Periodic updates 223, trigger updates 1
Interfaces:
```

```
GigabitEthernet0/0/0
Redistribution:
  Redistributing protocol bgp 65001 route-map bgp-to-rip
```

In the following example, output information about a specified IPv6 RIP process database is displayed using the **show ipv6 rip** command with the *name* argument and the **database** keyword. In the following output for the IPv6 RIP process named process1, timer information is displayed, and route 2001:DB8::16/64 has a route tag set:

```
Router> show ipv6 rip process1 database
RIP process "process1", local RIB
  2001:DB8::/64, metric 2
    GigabitEthernet0/0/0/FE80::A8BB:CCFF:FE00:B00, expires in 13 secs
  2001:DB8::/16, metric 2 tag 4, installed
    GigabitEthernet0/0/0/FE80::A8BB:CCFF:FE00:B00, expires in 13 secs
  2001:DB8:1::/16, metric 2 tag 4, installed
    GigabitEthernet0/0/0/FE80::A8BB:CCFF:FE00:B00, expires in 13 secs
  2001:DB8:2::/16, metric 2 tag 4, installed
    GigabitEthernet0/0/0/FE80::A8BB:CCFF:FE00:B00, expires in 13 secs
  ::/0, metric 2, installed
    GigabitEthernet0/0/0/FE80::A8BB:CCFF:FE00:B00, expires in 13 secs
```

In the following example, output information for a specified IPv6 RIP process is displayed using the **show ipv6 rip** user EXEC command with the *name* argument and the **next-hops** keyword:

```
Router> show ipv6 rip process1 next-hops
RIP process "process1", Next Hops
  FE80::A8BB:CCFF:FE00:A00/GigabitEthernet0/0/0 [4 paths]
```

Sample Output for the show ipv6 route Command

The current metric of the route can be found by entering the **show ipv6 route** command. In the following example, output information for all IPv6 RIP routes is displayed using the **show ipv6 route** command with the **rip** protocol keyword:

```
Router> show ipv6 route rip
IPv6 Routing Table - 17 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
R   2001:DB8:1::/32 [120/2]
    via FE80::A8BB:CCFF:FE00:A00, gigabitEthernet0/0/0
R   2001:DB8:2::/32 [120/2]
    via FE80::A8BB:CCFF:FE00:A00, gigabitEthernet0/0/0
R   2001:DB8:3::/32 [120/2]
    via FE80::A8BB:CCFF:FE00:A00, gigabitEthernet0/0/0
```

Sample Output for the debug ipv6 rip Command

In the following example, debugging messages for IPv6 RIP routing transactions are displayed using the **debug ipv6 rip** command:

```
Router# debug ipv6 rip
RIPng: Sending multicast update on gigabitEthernet0/0/0 for process1
  src=FE80::A8BB:CCFF:FE00:B00
  dst=FF02::9 (gigabitEthernet0/0/0)
  sport=521, dport=521, length=112
  command=2, version=1, mbz=0, #rte=5
  tag=0, metric=1, prefix=2001:DB8::/64
  tag=4, metric=1, prefix=2001:DB8:1::/16
  tag=4, metric=1, prefix=2001:DB8:2::/16
  tag=4, metric=1, prefix=2001:DB8:3::/16
  tag=0, metric=1, prefix=::/0
RIPng: Next RIB walk in 10032
```

```

RIPng: response received from FE80::A8BB:CCFF:FE00:A00 on gigabitethernet0/0/0 for
process1
  src=FE80::A8BB:CCFF:FE00:A00 (gigabitethernet0/0/0)
  dst=FF02::9
  sport=521, dport=521, length=92
  command=2, version=1, mbz=0, #rte=4
  tag=0, metric=1, prefix=2001:DB8::/64
  tag=0, metric=1, prefix=2001:DB8:1::/32
  tag=0, metric=1, prefix=2001:DB8:2::/32
  tag=0, metric=1, prefix=2001:DB8:3::/32

```

Configuration Examples for IPv6 RIP

- [Example IPv6 RIP Configuration, page 12](#)

Example IPv6 RIP Configuration

In the following example, the IPv6 RIP process named process1 is enabled on the router and on Gigabit Ethernet interface 0/0/0. The IPv6 default route (::/0) is advertised in addition to all other routes in router updates sent on Gigabit Ethernet interface 0/0/0. Additionally, BGP routes are redistributed into the RIP process named process1 according to a route map where routes that match a prefix list are also tagged. The number of parallel paths is set to one to allow the route tagging, and the IPv6 RIP timers are adjusted. A prefix list named eth0/0-in-flt filters inbound routing updates on Gigabit Ethernet interface 0/0/0.

```

ipv6 router rip process1
  maximum-paths 1
  redistribute bgp 65001 route-map bgp-to-rip
  distribute-list prefix-list eth0/0-in-flt in Gigabitethernet0/0/0
!
interface Gigabitethernet0/0/0
  ipv6 address 2001:DB8::/64 eui-64
  ipv6 rip process1 enable
  ipv6 rip process1 default-information originate
!
ipv6 prefix-list bgp-to-rip-flt seq 10 deny 2001:DB8:3::/16 le 128
ipv6 prefix-list bgp-to-rip-flt seq 20 permit 2001:DB8:1::/8 le 128
!
ipv6 prefix-list eth0/0-in-flt seq 10 deny ::/0
ipv6 prefix-list eth0/0-in-flt seq 15 permit ::/0 le 128
!
route-map bgp-to-rip permit 10
  match ipv6 address prefix-list bgp-to-rip-flt
  set tag 4

```

Additional References

Related Documents

Related Topic	Document Title
IPv4 RIP configuration tasks	" Configuring Routing Information Protocol ," <i>Cisco IOS XE IP Routing Protocols Configuration Guide</i>

Related Topic	Document Title
RIP commands: complete command syntax, command mode, defaults, usage guidelines, and examples	"RIP Commands," <i>Cisco IOS IP Routing Protocols Command Reference</i>
IPv6 supported feature list	"Start Here: Cisco IOS XE Software Release Specifics for IPv6 Features," <i>Cisco IOS XE IPv6 Configuration Guide</i>
IPv6 commands: complete command syntax, command mode, defaults, usage guidelines, and examples	<i>Cisco IOS IPv6 Command Reference</i>
Cisco IOS master command list, all releases	Cisco IOS Master Command List, All Releases

Standards

Standards	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
None	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

RFCs	Title
RFC 2080	<i>RIPng for IPv6</i>

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Implementing RIP for IPv6

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 Implementing RIP for IPv6*

Feature Name	Releases	Feature Information
IPv6--RIPng Nonstop Forwarding	Cisco IOS XE Release 2.1	IPv6 RIP supports NSF.
IPv6 Routing--RIP for IPv6 (RIPng)	Cisco IOS XE Release 2.1	RIP enhancements for IPv6 include support for IPv6 addresses and prefixes, and the use of the all-RIP-routers multicast group address FF02::9 as the destination address for RIP update messages. The following commands were modified by this feature: debug ipv6 rip, ipv6 rip default-information, ipv6 rip enable, ipv6 router rip, ipv6 unicast-routing, maximum paths, distribute-list prefix-list (IPv6 RIP), ipv6 prefix-list, show ipv6 rip, timers (IPv6 RIP)

Feature Name	Releases	Feature Information
IPv6 Routing--Route Redistribution	Cisco IOS XE Release 2.1	Routes may be specified by prefix, using a route-map prefix list, or by tag, using the route-map "match tag" function. The following commands were modified by this feature: ipv6 rip enable, match ipv6 address, redistribute, route-map, set tag, show ipv6 route

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