Cisco IOS IP Routing: Protocol-Independent Command Reference

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Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

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CONTENTS

Introduction

This book describes the commands used to configure and monitor IP Protocol-Independent routing capabilities and features.

For IP Protocol-Independent routing protocols configuration information and examples, refer to the *Cisco IOS IP Routing: Protocol-Independent Configuration Guide*.

IP Routing Protocol-Independent Commands

accept-lifetime

To set the time period during which the authentication key on a key chain is received as valid, use the **accept-lifetime** command in key chain key configuration mode. To revert to the default value, use the **no** form of this command.

accept-lifetime *start-time* {**infinite** | *end-time* | **duration** *seconds*}

no accept-lifetime [*start-time* {**infinite** | *end-time* | **duration** *seconds*}]

Syntax Description

start-time	Beginning time that the key specified by the **key** command is valid to be received. The syntax can be either of the following: *hh*:*mm*:*ss Month date year* *hh*:*mm*:*ss date Month year* *hh*—hours *mm*—minutes *ss*—seconds *Month*—first three letters of the month *date*—date (1–31) *year*—year (four digits) The default start time and the earliest acceptable date is January 1, 1993.
infinite	Key is valid to be received from the *start-time* value on.
end-time	Key is valid to be received from the *start-time* value until the *end-time* value. The syntax is the same as that for the *start-time* value. The *end-time* value must be after the *start-time* value. The default end time is an infinite time period.
duration *seconds*	Length of time (in seconds) that the key is valid to be received. The range is from 1 to 2147483646.

Command Default

Forever (the starting time is January 1, 1993, and the ending time is infinite)

Command Modes

Key chain key configuration

Command History

Release	Modification
11.1	This command was introduced.
12.4(6)T	Support for IPv6 was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Only DRP Agent, Enhanced Interior Gateway Routing Protocol (EIGRP), and Routing Information Protocol (RIP) Version 2 use key chains.

Specify a *start-time* value and one of the following values: **infinite**, *end-time*, or **duration** *seconds.*

We recommend running Network Time Protocol (NTP) or some other time synchronization method if you assign a lifetime to a key.

If the last key expires, authentication will continue and an error message will be generated. To disable authentication, you must manually delete the last valid key.

Examples

The following example configures a key chain called keychain1. The key named string1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named string2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or discrepancies in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
interface ethernet 0
 ip rip authentication key-chain keychain1
 ip rip authentication mode md5
!
router rip
 network 172.19.0.0
 version 2
!
key chain keychain1
 key 1
 key-string string1
 accept-lifetime 13:30:00 Jan 25 1996 duration 7200
 send-lifetime 14:00:00 Jan 25 1996 duration 3600
 key 2
 key-string string2
 accept-lifetime 14:30:00 Jan 25 1996 duration 7200
 send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

Command	Description
key	Identifies an authentication key on a key chain.
key chain	Enables authentication for routing protocols.
key-string (authentication)	Specifies the authentication string for a key.
send-lifetime	Sets the time period during which an authentication key on a key chain is valid to be sent.
show key chain	Displays authentication key information.

bfd

To set the baseline Bidirectional Forwarding Detection (BFD) session parameters on an interface, use the **bfd** command in interface configuration mode. To remove the baseline BFD session parameters, use the **no** form of this command.

bfd interval *milliseconds* **min_rx** *milliseconds* **multiplier** *multiplier-value*

no bfd interval *milliseconds* **min_rx** *milliseconds* **multiplier** *multiplier-value*

Syntax Description

interval *milliseconds*	Specifies the rate at which BFD control packets will be sent to BFD peers. The configurable time period for the *milliseconds* argument is from 50 to 999 milliseconds (ms).
min_rx *milliseconds*	Specifies the rate at which BFD control packets will be expected to be received from BFD peers. The configurable time period for the *milliseconds* argument is from 50 to 999 ms.
multiplier *multiplier-value*	Specifies the number of consecutive BFD control packets that must be missed from a BFD peer before BFD declares that the peer is unavailable and the Layer 3 BFD peer is informed of the failure. The configurable value range for the *multiplier-value* argument is from 3 to 50.

Command Default

No baseline BFD session parameters are set.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.4(4)T	This command was integrated into Cisco IOS Release 12.4(4)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 Series Aggregation Services Routers.
12.2(33)SRE	This command was modified. Support for IPv6 was added.
15.0(1)M	This command was modified. Support was removed from ATM and inverse multiplexing over ATM (IMA) interfaces.

Usage Guidelines

The **bfd** command can be configured on the following interfaces:

- ATM
- Dot1Q VLAN subinterfaces (with an IP address on the Dot1Q subinterface)

- Ethernet
- Frame Relay
- IMA
- PoS
- Serial

Other interface types are not supported by BFD.

Note The **bfd interval** command is not supported on ATM and IMA interfaces in Cisco IOS Release 15.0(1)M and later releases.

Examples

The following example shows the BFD session parameters set for Fast Ethernet interface 3/0:

```
Router> enable
Router# configure terminal
Router(config)# interface fastethernet 3/0
Router(config-if)# bfd interval 50 min_rx 50 multiplier 3
Router(config-if)# end
```

Related Commands

Command	Description
bfd all-interfaces	Enables BFD for all interfaces for a BFD peer.
bfd interface	Enables BFD on a per-interface basis for a BFD peer.
clear bfd	Clears BFD session parameters.
ip ospf bfd	Enables BFD on a specific interface configured for OSPF.

bfd all-interfaces

To enable Bidirectional Forwarding Detection (BFD) for all interfaces participating in the routing process, use the **bfd all-interfaces** command in router configuration mode. To disable BFD for all interfaces, use the **no** form of this command.

bfd all-interfaces

no bfd all-interfaces

Syntax Description

This command has no arguments or keywords.

Command Default

BFD is not enabled on the interfaces participating in the routing process.

Command Modes

Router configuration

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.4(4)T	This command was integrated into Cisco IOS Release 12.4(4)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.

Usage Guidelines

There are two methods to configure routing protocols to use BFD for failure detection. To enable BFD for all neighbors of a routing protocol, enter the **bfd all-interfaces** command in router configuration mode. If you do not want to enable BFD on all interfaces, enter the **bfd interface** command in router configuration mode.

Examples

The following example shows BFD enabled for all Enhanced Interior Gateway Routing Protocol (EIGRP) neighbors:

```
Router> enable
Router# configure terminal
Router(config)# router eigrp 123
Router(config-router)# bfd all-interfaces
Router(config-router)# end
```

The following example shows BFD enabled for all Intermediate System-to-Intermediate System (IS-IS) neighbors:

```
Router> enable
Router# configure terminal
Router(config)# router isis tag1
Router(config-router)# bfd all-interfaces
Router(config-router)# end
```

The following example shows BFD enabled for all Open Shortest Path First (OSPF) neighbors:

```
Router> enable
Router# configure terminal
Router(config)# router ospf 123
Router(config-router)# bfd all-interfaces
Router(config-router)# end
```

Related Commands

Command	Description
bfd	Sets the baseline BFD session parameters on an interface.
bfd interface	Enables BFD on a per-interface basis for a BFD peer.

bfd echo

To enable Bidirectional Forwarding Detection (BFD) echo mode, use the **bfd echo** command in interface configuration mode. To disable BFD echo mode, use the **no** form of this command.

bfd echo

no bfd echo

Syntax Description

This command has no arguments or keywords.

Command Default

BFD echo mode is enabled by default.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.4(9)T	This command was introduced.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
15.0(1)M	This command was modified. Support was removed from ATM and inverse multiplexing over ATM (IMA) interfaces.

Usage Guidelines

Echo mode is enabled by default. Entering the **no bfd echo** command without any keywords turns off the sending of echo packets and signifies that the router is unwilling to forward echo packets received from BFD neighbor routers.

When echo mode is enabled, the desired minimum echo transmit interval and required minimum transmit interval values are taken from the **bfd interval** *milliseconds* **min_rx** *milliseconds* parameters, respectively.

Note If the **no ip route-cache same-interface** command is configured, the **bfd echo accept** command will not be accepted.

Note Before using BFD echo mode, you must disable the sending of Internet Control Message Protocol (ICMP) redirect messages by entering the **no ip redirects** command, in order to avoid high CPU utilization.

The **bfd echo** command is not supported on ATM and IMA interfaces Cisco IOS Release 15.0(1)M and later releases.

Echo Mode Without Asymmetry

Echo mode is described as without asymmetry when it is running on both sides (both BFD neighbors are running echo mode).

Examples

The following example configures echo mode between BFD neighbors:

```
Router> enable
Router# configure terminal
Router(config)# interface Ethernet 0/1
Router(config-if)# bfd echo
```

The following output from the **show bfd neighbors details** command shows that the BFD session neighbor is up and using BFD echo mode. The relevant command output is shown in bold in the output.

```
Router# show bfd neighbors details

OurAddr       NeighAddr      LD/RD  RH/RS    Holdown(mult)State    Int
172.16.1.2    172.16.1.1     1/6    Up       0    (3 )    Up       Fa0/1
Session state is UP and using echo function with 50 ms interval.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 3
Received MinRxInt: 1000000, Received Multiplier: 3
Holdown (hits): 3000(0), Hello (hits): 1000(337)
Rx Count: 341, Rx Interval (ms) min/max/avg: 1/1008/882 last: 364 ms ago
Tx Count: 339, Tx Interval (ms) min/max/avg: 1/1016/886 last: 632 ms ago
Registered protocols: EIGRP
Uptime: 00:05:00
Last packet: Version: 1            - Diagnostic: 0
             State bit: Up         - Demand bit: 0
             Poll bit: 0           - Final bit: 0
             Multiplier: 3         - Length: 24
             My Discr.: 6          - Your Discr.: 1
             Min tx interval: 1000000    - Min rx interval: 1000000
             Min Echo interval: 50000
```

Related Commands

Command	Description
bfd	Sets the baseline BFD session parameters on the interface.
ip redirects	Enables the sending of ICMP redirect messages if the Cisco IOS software is forced to resend a packet through the same interface on which it was received.
ip route-cache	Controls the use of switching methods for forwarding IP packets.

bfd interface

To enable Bidirectional Forwarding Detection (BFD) on a per-interface basis for a BFD peer, use the **bfd interface** command in router configuration mode. To disable BFD on a per-interface basis, use the **no** form of this command.

bfd interface *type number*

no bfd interface *type number*

Syntax Description

type	Interface type for the interface to be enabled for BFD.
number	Interface number for the interface to be enabled for BFD.

Command Default

BFD is not enabled on the interface.

Command Modes

Router configuration

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.4(4)T	This command was integrated into Cisco IOS Release 12.4(4)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

There are two methods to configure routing protocols to use BFD for failure detection. To enable BFD for all neighbors of a routing protocol, enter the **bfd all-interfaces** command in router configuration mode. If you do not want to enable BFD on all interfaces, enter the **bfd interface** command in router configuration mode.

Examples

The following example shows BFD enabled for the Enhanced Interior Gateway Routing Protocol (EIGRP) neighbor Fast Ethernet interface 3/0:

```
Router> enable
Router# configure terminal
Router(config)# router eigrp 123
Router(config-router)# bfd interface fastethernet 3/0
Router(config-if)# end
```

Related Commands

Command	Description
bfd	Sets the baseline BFD session parameters on an interface.
bfd all-interfaces	Enables BFD for all interfaces for a BFD peer.

bfd slow-timers

To configure the Bidirectional Forwarding Detection (BFD) slow timers value, use the **bfd slow-timers** command in global configuration mode. This command does not have a **no** form.

bfd slow-timers [*milliseconds*]

Syntax Description

milliseconds	(Optional) BFD slow timers value, in milliseconds. The range is from 1000 to 30000. The default is 1000.

Command Default

The BFD slow timer value is 1000 milliseconds.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.4(9)T	This command was introduced.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Examples

The following example shows how to configure the BFD slow timers value to 14,000 milliseconds:

```
Router(config)# bfd slow-timers 14000
```

The following output from the **show bfd neighbors details** command shows that the BFD slow timers value of 14,000 milliseconds has been implemented. The values for the MinTxInt and MinRxInt will correspond to the configured value for the BFD slow timers. The relevant command output is shown in bold.

```
Router# show bfd neighbors details

OurAddr       NeighAddr     LD/RD  RH/RS   Holdown(mult)  State     Int
172.16.10.1   172.16.10.2   1/1    Up      0    (3 )      Up        Et2/0
Session state is UP and using echo function with 50 ms interval.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 14000, MinRxInt: 14000, Multiplier: 3
Received MinRxInt: 10000, Received Multiplier: 3
Holdown (hits): 3600(0), Hello (hits): 1200(418)
Rx Count: 422, Rx Interval (ms) min/max/avg: 1/1480/1087 last: 112 ms ago
Tx Count: 420, Tx Interval (ms) min/max/avg: 1/2088/1090 last: 872 ms ago
Registered protocols: OSPF
Uptime: 00:07:37
Last packet: Version: 1            - Diagnostic: 0
             State bit: Up         - Demand bit: 0
             Poll bit: 0           - Final bit: 0
             Multiplier: 3         - Length: 24
             My Discr.: 1          - Your Discr.: 1
```

```
Min tx interval: 14000 - Min rx interval: 14000
Min Echo interval: 4000
```

Related Commands

Command	Description
bfd echo	Enables BFD echo mode.

bfd-template

To create a Bidirectional Forwarding Detection (BFD) template and to enter BFD configuration mode, use the **bfd-template** command in global configuration mode. To disable a BFD template, use the **no** form of this command.

bfd-template single-hop *template-name*

no bfd-template single-hop *template-name*

Syntax Description

single-hop	Specifies a single-hop BFD template.
template-name	The template name.

Command Default

The BFD template does not exist.

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)S	This command was introduced.

Usage Guidelines

The **bfd-template** command allows you to create a BFD template and enter BFD configuration mode. The template can be used to specify a set of BFD interval values. BFD interval values specified as part of the BFD template are not specific to a single interface.

Examples

The following example shows how to create a BFD template and specify BFD interval values:

```
Router(config)# bfd-template single-hop node1
Router(bfd-config)# interval min-tx 100 min-rx 100 multiplier 3
```

Related Commands

Command	Description
bfd	Set the baseline BFD session parameters on an interface.
bfd all-interfaces	Enables BFD for all interfaces participating in the routing process.
bfd echo	Enables BFD echo mode.
bfd interface	Enables BFD on a per-interface basis for a BFD peer.
bfd slow-timer	Configures the BFD slow timer value.
interval	Configures the transmit and receive intervals between BFD packets.

dampening

To configure a router to automatically dampen a flapping interface, use the **dampening** command in interface configuration mode. To disable automatic route dampening, use the **no** form of this command.

dampening [*half-life-period reuse-threshold*] [*suppress-threshold max-suppress-time* [*restart-penalty*]]

no dampening

Syntax Description

half-life-period	(optional) Time (in seconds) after which a penalty is decreased. Once the route has been assigned a penalty, the penalty is decreased by half after the half-life period expires. The range of the half-life period is from 1 to 30 seconds. The default time is 5 seconds.
reuse-threshold	(optional) Reuse value based on the number of penalties. When the accumulated penalty decreases enough to fall below this value, the route is unsuppressed. The range of the reuse value is from 1 to 20000; the default is 1000.
suppress-threshold	(optional) Value of the accumulated penalty that triggers the router to dampen a flapping interface.A route is suppressed when its penalty exceeds this limit. The range is from 1 to 20000; the default is 2000.
max-suppress-time	(optional) Maximum time (in seconds) a route can be suppressed. The range is from 1 to 20000; the default is four times the *half-life-period value*. If the *half-life-period* value is allowed to default, the maximum suppress time defaults to 20 seconds.
restart-penalty	(optional) Penalty to applied to the interface when it comes up for the first time after the router reloads. The configurable range is from 1 to 20000 penalties. The default is 2000 penalties. This argument is not required for any other configurations.

Defaults

This command is disabled by default. To manually configure the timer for the *restart-penalty* argument, the value for all arguments must be manually entered.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(22)S	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
12.2(18)SXD	This command was integrated into Cisco IOS Release 12.2(18)SXD.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.

Usage Guidelines

The IP Event Dampening feature will function on a subinterface but cannot be configured on only the subinterface. Only the primary interface can be configured with this feature. Primary interface configuration is applied to all subinterfaces by default.

When an interface is dampened, the interface is dampened to both IP and Connectionless Network Services (CLNS) routing equally. The interface is dampened to both IP and CLNS because integrated routing protocols such as Intermediate System-to-Intermediate System (IS-IS), IP, and CLNS routing protocols are closely interconnected, so it is impossible to apply dampening separately.

Copying a dampening configuration from virtual templates to virtual access interfaces is not supported because dampening has limited usefulness to existing applications using virtual templates. Virtual access interfaces are released when an interface flaps, and new connections and virtual access interfaces are acquired when the interface comes up and is made available to the network. Because dampening states are attached to the interface, the dampening states would not survive an interface flap.

If the **dampening** command is applied to an interface that already has dampening configured, all dampening states are reset and the accumulated penalty will be set to 0. If the interface has been dampened, the accumulated penalty will fall into the reuse threshold range, and the dampened interface will be made available to the network. The flap counts, however, are retained.

Examples

The following example sets the half life to 30 seconds, the reuse threshold to 1500, the suppress threshold to 10000, and the maximum suppress time to 120 seconds:

```
interface Ethernet 0/0
 dampening 30 1500 10000 120
```

The following example configures the router to apply a penalty of 500 on Ethernet interface 0/0 when the interface comes up for the first time after the router is reloaded:

```
interface Ethernet 0/0
 dampening 5 500 1000 20 500
```

Related Commands

Command	Description
clear counters	Clears the interface counters.
show dampening interface	Displays a summary of interface dampening.
show interface dampening	Displays a summary of the dampening parameters and status.

distance (IP)

To define an administrative distance for routes that are inserted into the routing table, use the **distance** command in router configuration mode. To return the administrative distance to its default distance definition, use the **no** form of this command.

distance *distance ip-address wildcard-mask* [*ip-standard-acl* | *ip-extended-acl* | *access-list-name*]

no distance *distance ip-address wildcard-mask* [*ip-standard-acl* | *ip-extended-acl* | *access-list-name*]

Syntax Description

distance	Administrative distance. An integer from 10 to 255. (The values 0 to 9 are reserved for internal use. Routes with a distance value of 255 are not installed in the routing table.)
ip-address	IP address in four-part, dotted decimal notation. The IP address or the network address from where routes are learned.
wildcard-mask	Wildcard mask in four-part, dotted decimal notation. A bit set to 1 in the *wildcard-mask* argument instructs the software to ignore the corresponding bit in the address value.
ip-standard-acl	(Optional) Standard IP access list (ACL) number to be applied to incoming routing updates.
ip-extended-acl	(Optional) Extended IP access list to be applied to incoming routing updates.
access-list-name	(Optional) Named access list to be applied to incoming routing updates.

Command Default

For information on default administrative distances, see the "Usage Guidelines" section.

Command Modes

Router configuration (config-router)

Command History

Release	Modification
10.0	This command was introduced.
11.2	This command was modified. The *access-list-name* argument was added.
11.3	This command was modified. The **ip** keyword was removed.
12.0	This command was modified. The *ip-standard-acl* and *ip-extended-acl* arguments were added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Release	Modification
Cisco IOS XE Release 2.1	This command was integrated into Cisco IOS XE Release 2.1.
15.0(1)M	This command was integrated into a release earlier than Cisco IOS Release 15.0(1)M.

Usage Guidelines

Table 1 lists default administrative distances.

Table 1 Default Administrative Distances

Route Source	Default Distance
Connected interface	0
Static route	1
Enhanced Interior Gateway Routing Protocol (EIGRP) summary route	5
External Border Gateway Protocol (eBGP)	20
Internal EIGRP	90
Open Shortest Path First (OSPF)	110
Intermediate System-to-Intermediate System (IS-IS)	115
Routing Information Protocol (RIP)	120
EIGRP external route	170
Internal BGP	200
Unknown	255

An administrative distance is a rating of the trustworthiness of a routing information source, such as an individual router or a group of routers. Numerically, an administrative distance is an integer from 0 to 255. In general, the higher the value, the lower the trust rating. An administrative distance of 255 means the routing information source cannot be trusted at all and should be ignored.

When the optional access list name is used with this command, it is applied when a network is being inserted into the routing table. This behavior allows filtering of networks according to the IP address of the router that supplies the routing information. This option could be used, for example, to filter possibly incorrect routing information from routers that are not under your administrative control.

The order in which you enter **distance** commands can affect the assigned administrative distances in unexpected ways. See the “Examples” section for further clarification.

For BGP, the **distance** command sets the administrative distance of the External BGP (eBGP) route.

The **show ip protocols** privileged EXEC command displays the default administrative distance for the active routing processes.

Always set the administrative distance from the least to the most specific network.

Note The weight of a route can no longer be set with the **distance** command. To set the weight for a route, use a route map.

Examples

In the following example, the **router eigrp** global configuration command sets up EIGRP routing in autonomous system number 109. The **network** router configuration commands specify EIGRP routing on networks 192.168.7.0 and 172.16.0.0. The first **distance** command sets the administrative distance to 90 for all routers on the Class C network 192.168.7.0. The second **distance** command sets the administrative distance to 120 for the router with the address 172.16.1.3.

```
Router> enable
Router# configure terminal
Router(config)# router eigrp 109
Router(config-router)# network 192.168.7.0
Router(config-router)# network 172.16.0.0
Router(config-router)# distance 90 192.168.7.0 0.0.0.255
Router(config-router)# distance 120 172.16.1.3 0.0.0.255
Router(config-router)# end
```

In the following example, the set distance is from the least to the most specific network:

```
Router> enable
Router# configure terminal
Router(config)# router eigrp 109
Router(config-router)# distance 22 10.0.0.0 0.0.0.255
Router(config-router)# distance 33 10.11.0.0 0.0.0.255
Router(config-router)# distance 44 10.11.12.0 0.0.0.255
Router(config-router)# end
```

Note In this example, adding distance 255 to the end of the list would override the distance values for all networks within the range specified in the example. The result would be that the distance values are set to 255.

Entering the **show ip protocols** command displays the default administrative distance for the active routing processes, as well as the user-configured administrative distances:

```
Router# show ip protocols
.
.
.
Routing Protocol is "isis tag1"
  Invalid after 0 seconds, hold down 0, flushed after 0
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: isis
  Address Summarization:
    None
  Maximum path: 4
  Routing for Networks:
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: (default is 115)
    Address         Wild mask       Distance  List
    10.11.0.0             0.0.0.255       45
    10.0.0.0              0.0.0.255       22
    Address         Wild mask       Distance  List
    10.11.0.0             0.0.0.255       33
    10.11.12.0            0.0.0.255       44
```

Related Commands

Command	Description
distance (IPv6)	Configures an administrative distance for IS-IS, RIP, or OSPF IPv6 routes inserted into the IPv6 routing table.
distance (ISO CLNS)	Configures the administrative distance for CLNS routes learned.
distance bgp	Allows the use of external, internal, and local administrative distances that could be a better route to a node.
distance bgp (IPv6)	Allows the use of external, internal, and local administrative distances that could be a better route than other external, internal, or local routes to a node.
distance eigrp	Allows the use of two administrative distances—internal and external—that could be a better route to a node.
distance ospf	Defines OSPF route administrative distances based on route type.
show ip protocols	Displays the parameters and current state of the active routing protocol process.

distribute-list in (IP)

To filter networks received in updates, use the **distribute-list in** command in the appropriate configuration mode. To change or cancel the filter, use the **no** form of this command.

distribute-list [[*access-list-number* | *name*] | [**route-map** *map-tag*]] **in** [*interface-type* | *interface-number*]

no distribute-list [[*access-list-number* | *name*] | [**route-map** *map-tag*]] **in** [*interface-type* | *interface-number*]

Syntax Description

access-list-number | *name*	(Optional) Standard IP access list number or name. The list defines which networks are to be received and which are to be suppressed in routing updates.
route-map *map-tag*	(Optional) Name of the route map that defines which networks are to be installed in the routing table and which are to be filtered from the routing table. This argument is supported by OSPF and EIGRP.
in	Applies the access list to incoming routing updates.
interface-type	(Optional) Interface type. The *interface-type* argument cannot be used in address family configuration mode.
interface-number	(Optional) Interface number on which the access list should be applied to incoming updates. If no interface is specified, the access list will be applied to all incoming updates. The interface *type* and *number* arguments can apply if you specify an access list, not a route map. The *interface-number* argument cannot be used in address family configuration mode.

Defaults

This command is disabled by default.

Command Modes

Address family configuration (config-af)
Router address family topology configuration (config-router-af-topology)
Router configuration (config-router)

Command History

Release	Modification
10.0	This command was introduced.
11.2	The *access-list-name*, *type*, and *number* arguments were added.
12.0(7)T	Address family configuration mode was added.
12.0(24)S	The **route-map** *map-tag* keyword and argument were added.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Release	Modification
12.2(33)SRB	This command was made available in router address family topology configuration mode.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

This command must specify either an access list or a map-tag name of a route map. The route map is supported for OSPF and EIGRP filtering.

The *interface-type* and *interface-number* arguments cannot be used in address family configuration mode.

OSPF routes cannot be filtered from entering the OSPF database. If you use this command for OSPF, it only filters routes from the routing table; it does not prevent link-state packets from being propagated.

If a route map is specified, the route map can be based on the following **match** options:

- **match interface**
- **match ip address**
- **match ip next-hop**
- **match ip route-source**
- **match metric**
- **match route-type**
- **match tag**

Configure the route map before specifying it in the **distribute-list in** command.

Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **distribute-list in** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

Examples

In the following example, EIGRP process 1 is configured to accept two networks—network 0.0.0.0 and network 10.108.0.0:

```
access-list 1 permit 0.0.0.0
access-list 1 permit 10.108.0.0
access-list 1 deny 0.0.0.0 255.255.255.255
router eigrp 1
 network 10.108.0.0
 distribute-list 1 in
```

In the following example, OSPF external LSAs have a tag. The value of the tag is examined before the prefix is installed in the routing table. All OSPF external prefixes that have the tag value of 777 are filtered (prevented from being installed in the routing table). The permit statement with sequence number 20 has no match conditions, and there are no other route-map statements after sequence number 20, so all other conditions are permitted.

```
route-map tag-filter deny 10
 match tag 777
route-map tag-filter permit 20
```

```
!
router ospf 1
 router-id 10.0.0.2
 log-adjacency-changes
 network 172.16.2.1 0.0.0.255 area 0
 distribute-list route-map tag-filter in
```

Related Commands

Command	Description
access-list (IP extended)	Defines an extended IP access list.
access-list (IP standard)	Defines a standard IP access list.
distribute-list out (IP)	Suppresses networks from being advertised in updates.
redistribute (IP)	Redistributes routes from one routing domain into another routing domain.

distribute-list out (IP)

To suppress networks from being advertised in updates, use the **distribute-list out** command in the appropriate configuration mode. To cancel this function, use the **no** form of this command.

distribute-list {*access-list-number* | *access-list-name*} **out** [*interface-name* | *routing-process* | *as-number*]

no distribute-list {*access-list-number* | *access-list-name*} **out** [*interface-name* | *routing-process* | *as-number*]

Syntax Description

access-list-number | *access-list-name*	Standard IP access list number or name. The list defines which networks are to be sent and which are to be suppressed in routing updates.
out	Applies the access list to outgoing routing updates.
interface-name	(Optional) Name of a particular interface. The *interface-name* argument cannot be used in address family configuration mode.
routing-process	(Optional) Name of a particular routing process, or the **static** or **connected** keyword.
as-number	(Optional) Autonomous system number.

Defaults

This command is disabled by default. Networks are advertised in updates.

Command Modes

Address family configuration (config-af)
Router address family topology configuration (config-router-af-topology)
Router configuration (config-router)

Command History

Release	Modification
10.0	This command was introduced.
11.2	The *access-list-name* argument was added.
12.0(7)T	Address family configuration mode was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was made available in router address family topology configuration mode.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

When networks are redistributed, a routing process name can be specified as an optional trailing argument to the **distribute-list** command. Specifying this option causes the access list to be applied to only those routes derived from the specified routing process. After the process-specific access list is

applied, any access list specified by a **distribute-list** command without a process name argument will be applied. Addresses not specified in the **distribute-list** command will not be advertised in outgoing routing updates.

The *interface-name* argument cannot be used in address family configuration mode.

Note To filter networks received in updates, use the **distribute-list in** command.

Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **distribute-list out** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

Examples

The following example would cause only one network to be advertised by a RIP routing process, network 10.108.0.0:

```
access-list 1 permit 10.108.0.0
access-list 1 deny 0.0.0.0 255.255.255.255
router rip
 network 10.108.0.0
 distribute-list 1 out
```

The following example applies access list 1 to outgoing routing updates. Only network 10.10.101.0 will be advertised in outgoing EIGRP routing updates.

```
router eigrp 100
 distribute-list 1 out
access-list 1 permit 10.10.101.0 0.0.0.255
```

Related Commands

Command	Description
access-list (IP extended)	Defines an extended IP access list.
access-list (IP standard)	Defines a standard IP access list.
distribute-list in (IP)	Filters networks received in updates.
redistribute (IP)	Redistributes routes from one routing domain into another routing domain.

interval (BFD)

To configure the transmit and receive intervals between BFD packets, and to specify the number of consecutive BFD control packets that must be missed before BFD declares that a peer is unavailable, use the **interval** command in BFD configuration mode. To disable interval values use the **no** form of this command.

interval {both *milliseconds* **| min-tx** *milliseconds* **min-rx** *milliseconds*} [**multiplier** *multiplier-value*]

no interval

Syntax Description

both *milliseconds*	Specifies the rate at which BFD control packets are sent to BFD peers and the rate at which BFD control packets are received from BFD peers. Range is from 50 to 999 milliseconds (ms).
min-tx *milliseconds*	Specifies the rate at which BFD control packets are sent to BFD peers. Range is from 50 to 999 ms.
min-rx *milliseconds*	Specifies the rate at which BFD control packets are received from BFD peers. Range is from 50 to 999 ms.
multiplier *multiplier-value*	(Optional) Specifies the number of consecutive BFD control packets that must be missed from a BFD peer before BFD declares that the peer is unavailable and the Layer 3 BFD peer is informed of the failure. Range is from 3 to 50. Default is 3.

Command Default

No session parameters are set.

Command Modes

BFD configuration (config-bfd)

Command History

Release	Modification
15.0(1)S	This command was introduced.

Usage Guidelines

The **interval** command allows you to configure the session parameters for a BFD template.

Examples

The following example shows how to configure interval settings for the node1 BFD template:

```
Router(config)# bfd-template single-hop node1
Router(bfd-config)# interval min-tx 120 min-rx 100 multiplier 3
```

Related Commands

Command	Description
bfd	Set the baseline BFD session parameters on an interface.
bfd all-interfaces	Enables BFD for all interfaces participating in the routing process.

Command	Description
bfd echo	Enables BFD echo mode.
bfd interface	Enables BFD on a per-interface basis for a BFD peer.
bfd slow-timer	Configures the BFD slow timer value.
bfd-template	Creates a BFD template and enters BFD configuration mode.

ip default-network

To select a network as a candidate route for computing the gateway of last resort, use the **ip default-network** command in global configuration mode. To remove a route, use the **no** form of this command.

ip default-network *network-number*

no ip default-network *network-number*

Syntax Description

network-number	Number of the network.

Command Default

If the router has a directly connected interface onto the specified network, the dynamic routing protocols running on that router will generate (or source) a default route. For Router Information Protocol (RIP), this is flagged as the pseudonetwork 0.0.0.0.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

The Cisco IOS software uses both administrative distance and metric information to determine the default route. Multiple **ip default-network** commands can be given. All candidate default routes, both static (that is, flagged by the **ip default-network** command) and dynamic, appear in the routing table preceded by an asterisk.

If the IP routing table indicates that the specified network number is subnetted and a nonzero subnet number is specified, then the system will automatically configure a static summary route. This static summary route is configured instead of a default network. The effect of the static summary route is to cause traffic destined for subnets that are not explicitly listed in the IP routing table to be routed using the specified subnet.

Examples

The following example defines a static route to network 10.0.0.0 as the static default route:

```
ip route 10.0.0.0 255.0.0.0 10.108.3.4
ip default-network 10.0.0.0
```

If the following command was issued on a router not connected to network 10.140.0.0, the software might choose the path to that network as a default route when the network appeared in the routing table:

```
ip default-network 10.140.0.0
```

Related Commands

Command	Description
show ip route	Displays the current state of the routing table.

ip gdp

To configure the router discovery mechanism, use the **ip gdp** command in global configuration mode. To disable the configuration, use the **no** form of this command.

ip gdp {**eigrp** | **irdp** [**multicast**] | **rip**}

no ip gdp {**eigrp** | **irdp** [**multicast**] | **rip**}

Syntax Description

eigrp	Configures a gateway to discover routers transmitting Enhanced Interior Gateway Routing Protocol (EIGRP) router updates.
irdp	Configures a gateway to discover routers transmitting ICMP Router Discovery Protocol (IRDP) router updates.
multicast	(Optional) Specifies the router to multicast IRDP solicitations.
rip	Configures a gateway to discover routers transmitting Routing Information Protocol (RIP) router updates.

Command Default

The router discovery mechanism is not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)M	This command was introduced in a release earlier than Cisco IOS Release 15.0(1)M.

Usage Guidelines

You must disable IP routing to configure the **ip gdp** command.

Examples

The following example shows how to configure the RIP router discovery mechanism:

```
Router# configure terminal
Router(config)# ip gdp rip
```

Related Commands

Command	Description
ip host	Defines static hostname-to-address mappings in the DNS hostname cache for a DNS view.
ip route	Establishes static routes.

ip local policy route-map

To identify a route map to use for local policy routing, use the **ip local policy route-map** command in global configuration mode. To disable local policy routing, use the **no** form of this command.

ip local policy route-map *map-tag*

no ip local policy route-map *map-tag*

Syntax Description

map-tag	Name of the route map to use for local policy routing. The name must match a *map-tag* value specified by a **route-map** command.

Defaults

Packets that are generated by the router are not policy routed.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Packets that are generated by the router are not normally policy routed. However, you can use this command to policy route such packets. You might enable local policy routing if you want packets originated at the router to take a route other than the obvious shortest path.

The **ip local policy route-map** command identifies a route map to use for local policy routing. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which packets should be policy routed. The **set** commands specify the *set actions*—the particular policy routing actions to perform if the criteria enforced by the **match** commands are met. The **no ip local policy route-map** command deletes the reference to the route map and disables local policy routing.

Examples

The following example sends packets with a destination IP address matching that allowed by extended access list 131 to the router at IP address 172.30.3.20:

```
ip local policy route-map xyz
!
route-map xyz
 match ip address 131
 set ip next-hop 172.30.3.20
```

Related Commands

Command	Description
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip default next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.
show ip local policy	Displays the route map used for local policy routing.

ip policy route-map

To identify a route map to use for policy routing on an interface, use the **ip policy route-map** command in interface configuration mode. To disable policy routing on the interface, use the **no** form of this command.

ip policy route-map *map-tag*

no ip policy route-map

Syntax Description

map-tag	Name of the route map to use for policy routing. The name must match a *map-tag* value specified by a **route-map** command.

Defaults

No policy routing occurs on the interface.

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

You might enable policy routing if you want your packets to take a route other than the obvious shortest path.

The **ip policy route-map** command identifies a route map to use for policy routing. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing is allowed for the interface, based on the destination IP address of the packet. The **set** commands specify the *set actions*—the particular policy routing actions to perform if the criteria enforced by the **match** commands are met. The **no ip policy route-map** command deletes the pointer to the route map.

Policy routing can be performed on any match criteria that can be defined in an extended IP access list when using the **match ip address c**ommand and referencing an extended IP access list.

Examples

The following example sends packets with the destination IP address of 172.21.16.18 to a router at IP address 172.30.3.20:

```
interface serial 0
 ip policy route-map policy_marketing
!
```

```
route-map policy_marketing
 match ip address 172.21.16.18
 set ip next-hop 172.30.3.20
```

Related Commands

Command	Description
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip default next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.

ip route

To establish static routes, use the **ip route** command in global configuration mode. To remove static routes, use the **no** form of this command.

ip route [vrf *vrf-name***]** *prefix mask* {*ip-address* | *interface-type interface-number* [*ip-address*]} [**dhcp**] [*distance*] [**name** *next-hop-name*] [**permanent** | **track** *number*] [**tag** *tag*]

no ip route [vrf *vrf-name***]** *prefix mask* {*ip-address* | *interface-type interface-number* [*ip-address*]} [**dhcp**] [*distance*] [**name** *next-hop-name*] [**permanent** | **track** *number*] [**tag** *tag*]

Syntax Description

vrf *vrf-name*	(Optional) Configures the name of the VRF by which static routes should be specified.
prefix	IP route prefix for the destination.
mask	Prefix mask for the destination.
ip-address	IP address of the next hop that can be used to reach that network.
interface-type interface-number	Network interface type and interface number.
dhcp	(Optional) Enables a Dynamic Host Configuration Protocol (DHCP) server to assign a static route to a default gateway (option 3). **Note** Specify the **dhcp** keyword for each routing protocol.
distance	(Optional) Administrative distance. The default administrative distance for a static route is 1.
name *next-hop-name*	(Optional) Applies a name to the next hop route.
permanent	(Optional) Specifies that the route will not be removed, even if the interface shuts down.
track *number*	(Optional) Associates a track object with this route. Valid values for the *number* argument range from 1 to 500.
tag *tag*	(Optional) Tag value that can be used as a "match" value for controlling redistribution via route maps.

Command Default

No static routes are established.

Command Modes

Global configuration (config)

Command History

Release	Modification
10.0	This command was introduced.
12.3(2)XE	The **track** keyword and *number* argument were added.
12.3(8)T	The **track** keyword and *number* argument were integrated into Cisco IOS Release 12.3(8)T. The **dhcp** keyword was added.

Release	Modification
12.3(9)	The changes made in Cisco IOS Release 12.3(8)T were added to Cisco IOS Release 12.3(9).
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.

Usage Guidelines

The establishment of a static route is appropriate when the Cisco IOS software cannot dynamically build a route to the destination.

When you specify a DHCP server to assign a static route, the interface type and number and administrative distance may be configured also.

If you specify an administrative distance, you are flagging a static route that can be overridden by dynamic information. For example, routes derived with Enhanced Interior Gateway Routing Protocol (EIGRP) have a default administrative distance of 90. To have a static route that would be overridden by an EIGRP dynamic route, specify an administrative distance greater than 100. Static routes have a default administrative distance of 100.

Static routes that point to an interface on a connected router will be advertised by way of Routing Information Protocol (RIP) and EIGRP regardless of whether **redistribute static** commands are specified for those routing protocols. This situation occurs because static routes that point to an interface are considered in the routing table to be connected and hence lose their static nature. Also, the target of the static route should be included in the **network** (DHCP) command. If this condition is not met, no dynamic routing protocol will advertise the route unless a **redistribute static** command is specified for these protocols. With the following configuration:

```
rtr1 (serial 172.16.188.1/30)--------------> rtr2(Fast Ethernet 172.31.1.1/30) ------>

router [rip | eigrp]
 network 172.16.188.0
 network 172.31.0.0
```

- RIP and EIGRP redistribute the route if the route is pointing to the Fast Ethernet interface:

  ```
  ip route 172.16.188.252 255.255.255.252 FastEthernet 0/0
  ```

  RIP and EIGRP do not redistribute the route with the following **ip route** command because of the split horizon algorithm:

  ```
  ip route 172.16.188.252 255.255.255.252 serial 2/1
  ```

- EIGRP redistributes the route with both of the following commands:

  ```
  ip route 172.16.188.252 255.255.255.252 FastEthernet 0/0
  ip route 172.16.188.252 255.255.255.252 serial 2/1
  ```

With the Open Shortest Path First (OSPF) protocol, static routes that point to an interface are not advertised unless a **redistribute static** command is specified.

Adding a static route to an Ethernet or other broadcast interface (for example, ip route 0.0.0.0 0.0.0.0 Ethernet 1/2) will cause the route to be inserted into the routing table only when the interface is up. This configuration is not generally recommended. When the next hop of a static route points to an interface, the router considers each of the hosts within the range of the route to be directly connected through that interface, and therefore it will send Address Resolution Protocol (ARP) requests to any destination addresses that route through the static route.

A logical outgoing interface, for example, a tunnel, needs to be configured for a static route. If this outgoing interface is deleted from the configuration, the static route is removed from the configuration and hence does not show up in the routing table. To have the static route inserted into the routing table again, configure the outgoing interface once again and add the static route to this interface.

The practical implication of configuring the **ip route 0.0.0.0 0.0.0.0 ethernet 1/2** command is that the router will consider all of the destinations that the router does not know how to reach through some other route as directly connected to Ethernet interface 1/2. So the router will send an ARP request for each host for which it receives packets on this network segment. This configuration can cause high processor utilization and a large ARP cache (along with memory allocation failures). Configuring a default route or other static route that directs the router to forward packets for a large range of destinations to a connected broadcast network segment can cause your router to reload.

Specifying a numerical next hop that is on a directly connected interface will prevent the router from using proxy ARP. However, if the interface with the next hop goes down and the numerical next hop can be reached through a recursive route, you may specify both the next hop and interface (for example, **ip route 0.0.0.0 0.0.0.0 ethernet 1/2 10.1.2.3**) with a static route to prevent routes from passing through an unintended interface.

Note Configuring a default route that points to an interface, such as **ip route 0.0.0.0 0.0.0.0 ethernet 1/2**, displays a warning message. This command causes the router to consider all the destinations that the router cannot reach through an alternate route, as directly connected to Ethernet interface 1/2. Hence, the router sends an ARP request for each host for which it receives packets on this network segment. This configuration can cause high processor utilization and a large ARP cache (along with memory allocation failures). Configuring a default route or other static route that directs the router to forward packets for a large range of destinations to a connected broadcast network segment can cause the router to reload.

The **name** *next-hop-name* keyword and argument combination allows you to associate static routes with names in your running configuration. If you have several static routes, you can specify names that describe the purpose of each static route in order to more easily identify each one.

The **track** *number* keyword and argument combination specifies that the static route will be installed only if the state of the configured track object is up.

Recursive Static Routing

In a recursive static route, only the next hop is specified. The output interface is derived from the next hop.

For the following recursive static route example, all destinations with the IP address prefix address prefix 192.168.1.1/32 are reachable via the host with address 10.0.0.2:

```
ip route 192.168.1.1 255.255.255.255 10.0.0.2
```

A recursive static route is valid (that is, it is a candidate for insertion in the IPv4 routing table) only when the specified next hop resolves, either directly or indirectly, to a valid IPv4 output interface, provided the route does not self-recurse, and the recursion depth does not exceed the maximum IPv4 forwarding recursion depth.

The following example defines a valid recursive IPv4 static route:

```
interface serial 2/0
 ip address 10.0.0.1 255.255.255.252
 exit
ip route 192.168.1.1 255.255.255.255 10.0.0.2
```

The following example defines an invalid recursive IPv4 static route. This static route will not be inserted into the IPv4 routing table because it is self-recursive. The next hop of the static route, 192.168.1.0/30, resolves via the first static route 192.168.1.0/24, which is itself a recursive route (that is, it only specifies a next hop). The next hop of the first route, 192.168.1.0/24, resolves via the directly connected route via the serial interface 2/0. Therefore, the first static route would be used to resolve its own next hop.

```
interface serial 2/0
 ip address 10.0.0.1 255.255.255.252
 exit
ip route 192.168.1.0 255.255.255.0 10.0.0.2
ip route 192.168.1.0 255.255.255.252 192.168.1.100
```

It is not normally useful to manually configure a self-recursive static route, although it is not prohibited. However, a recursive static route that has been inserted in the IPv4 routing table may become self-recursive as a result of some transient change in the network learned through a dynamic routing protocol. If this situation occurs, the fact that the static route has become self-recursive will be detected and the static route will be removed from the IPv4 routing table, although not from the configuration. A subsequent network change may cause the static route to no longer be self-recursive, in which case it will be re-inserted in the IPv4 routing table.

Note IPv4 recursive static routes are checked at one-minute intervals. Therefore, a recursive static route may take up to a minute to be inserted into the routing table once its next hop becomes valid. Likewise, it may take a minute or so for the route to disappear from the table if its next hop becomes invalid.

Examples

The following example shows how to choose an administrative distance of 110. In this case, packets for network 10.0.0.0 will be routed to a router at 172.31.3.4 if dynamic information with an administrative distance less than 110 is not available.

```
ip route 10.0.0.0 255.0.0.0 172.31.3.4 110
```

Note Specifying the next hop without specifying an interface when configuring a static route can cause traffic to pass through an unintended interface if the default interface goes down.

The following example shows how to route packets for network 172.31.0.0 to a router at 172.31.6.6:

```
ip route 172.31.0.0 255.255.0.0 172.31.6.6
```

The following example shows how to route packets for network 192.168.1.0 directly to the next hop at 10.1.2.3. If the interface goes down, this route is removed from the routing table and will not be restored unless the interface comes back up.

```
ip route 192.168.1.0 255.255.255.0 Ethernet 0 10.1.2.3
```

The following example shows how to install the static route only if the state of track object 123 is up:

```
ip route 0.0.0.0 0.0.0.0 Ethernet 0/1 10.1.1.242 track 123
```

The following example shows that using the **dhcp** keyword in a configuration of Ethernet interfaces 1 and 2 enables the interfaces to obtain the next-hop router IP addresses dynamically from a DHCP server:

```
ip route 10.165.200.225 255.255.255.255 ethernet1 dhcp
ip route 10.165.200.226 255.255.255.255 ethernet2 dhcp 20
```

The following example shows that using the **name** *next-hop-name* keyword and argument combination for each static route in the configuration helps you remember the purpose for each static route.

```
ip route 172.0.0.0 255.0.0.0 10.0.0.1 name Seattle2Detroit
```

The name for the static route will be displayed when the **show running-configuration** command is entered:

```
Router# show running-config | include ip route

ip route 172.0.0.0 255.0.0.0 10.0.0.1 name Seattle2Detroit
```

Related Commands

Command	Description
network (DHCP)	Configures the subnet number and mask for a DHCP address pool on a Cisco IOS DHCP server.
redistribute (IP)	Redistributes routes from one routing domain into another routing domain.

ip route profile

To enable IP routing table statistics collection, use the **ip route profile** command in global configuration mode. To disable collection of routing table statistics, use the **no** form of the command.

ip route profile

no ip route profile

Syntax Description

This command has no arguments or keywords.

Defaults

The time interval for each sample, or sampling interval, is a fixed value and is set at 5 seconds.

Command Modes

Global configuration

Command History

Release	Modification
12.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

The **ip route profile** command helps you to monitor routing table fluctuations that can occur as the result of route flapping, network failure, or network restoration.

This command identifies route flapping over brief time intervals. The time interval for each sample, or sampling interval, is a fixed value and is set at 5 seconds.

Two sets of statistics are collected. The per-interval statistics are collected over a sampling interval, while the routing table change statistics are the result of aggregating the per-interval statistics. The per-interval statistics are collected as a single set of counters, with one counter tracking one event. All counters are initialized at the beginning of each sampling interval; counters are incremented as corresponding events occur anywhere in the routing table.

At the end of a sampling interval, the per-interval statistics for that sampling interval are integrated with the routing table change statistics collected from the previous sampling intervals. The counters holding the per-interval statistics are reset and the process is repeated.

Routing table statistics are collected for the following events:

- Forward-Path Change. This statistic is the number of changes in the forwarding path, which is the accumulation of prefix-add, next-hop change, and pathcount change statistics.
- Prefix-Add. A new prefix was added to the routing table.
- Next-Hop Change. A prefix is not added or removed, but the next hop changes. This statistic is only seen with recursive routes that are installed in the routing table.

- Pathcount Change. The number of paths in the routing table has changed. This statistic is the result of an increase in the number of paths for an Interior Gateway Protocol (IGP) prefix in the routing table.
- Prefix Refresh. Standard routing table maintenance; the forwarding behavior is not changed.

Use the **show ip route profile** command to display the routing table change statistics.

Examples

The following example enables the collection of routing table statistics:

```
ip route profile
```

Related Commands

Command	Description
show ip route profile	Displays routing table change statistics.

ip route static adjust-time

To change the time interval for IP static route adjustments during convergence, use the **ip route static adjust-time** command in global configuration mode. To reinstate the default adjustment time of 60 seconds, use the **no** form of this command.

ip route static adjust-time *seconds*

no ip route static adjust-time *seconds*

Syntax Description

seconds	Time of delay, in seconds, for convergence time during which the background process that monitors next-hop reachability is performed. The delay in convergence occurs when the route that covers the next hop is removed. The range is from 1 to 60. The default is 60.

Defaults

seconds: 60

Command Modes

Global configuration

Command History

Release	Modification
12.0(29)S	This command was introduced.
12.3(10)	This command was integrated into Cisco IOS Release 12.3(10).
12.3(11)T	This command was integrated into Cisco IOS Release 12.3(11)T.

Usage Guidelines

By default, static route adjustments are made every 60 seconds. To adjust the timer to any interval from 1 to 60 seconds, enter the **ip route static adjust-time** command.

The benefit of reducing the timer from the 60-second default value is to increase the convergence when static routes are used. However, reducing the interval can be CPU intensive if the value is set very low and a large number of static routes are configured.

Examples

In the following example, the adjustment time for static routes has been changed from the default 60 seconds to 30 seconds:

```
Router(config)# ip route static adjust-time 30
```

To remove the 30-second adjusted time interval and reinstate the default 60-second value, enter the **no route ip static adjust-time** command:

```
Router(config)# no ip route static adjust-time 30
```

Related Commands

Command	Description
show ip route	Displays the current state of the routing table.

ip route static bfd

To specify static route Bidirectional Forwarding Detection (BFD) neighbors, use the **ip route static bfd** command in global configuration mode. To remove a static route BFD neighbor, use the **no** form of this command.

ip route static bfd *interface-type interface-number gateway*

no ip route static bfd *interface-type interface-number gateway*

Syntax Description

interface-type interface-number	Interface type and number.
gateway	Gateway IP address, in A.B.C.D format.

Defaults

No static BFD neighbors are specified.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRC	This command was introduced.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.

Usage Guidelines

Use the **ip route static bfd** command to specify static route neighbors. All of the static routes that have the same interface and gateway specified in the configuration share the same BFD session for reachability notification. BFD requires that BFD sessions are initiated on both endpoint routers. Therefore, this command must be configured on each endpoint router.

All static routes that specify the same values for *interface-type, interface-number,* and *gateway* will automatically use BFD to determine gateway reachability and take advantage of fast failure detection.

Both *interface-type interface-number* and *gateway* arguments are required because BFD currently only supports directly connected neighbors.

Examples

The following example shows how to configure the use of BFD for all static routes via a specified neighbor:

```
Router# configure terminal
Router(config)# ip route static bfd serial 2/0 10.1.1.1
```

Related Commands

Command	Description
debug ip routing static bfd	Enables debugging output on IP static BFD neighbor events.
show ip static route	Displays static process local Routing Information Base (RIB) information.

ip routing

To enable IP routing, use the **ip routing** command in global configuration mode. To disable IP routing, use the **no** form of this command.

ip routing

no ip routing

Syntax Description

This command has no arguments or keywords.

Defaults

IP routing is enabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

To bridge IP, the **no ip routing** command must be configured to disable IP routing. However, you need not specify **no ip routing** in conjunction with concurrent routing and bridging to bridge IP.

The ip routing command is disabled on the Cisco VG200 voice over IP gateway.

Disabling IP routing is not allowed if you are running Cisco IOS Release 12.2SX on a Catalyst 6000 platform. The workaround is to not assign an IP address to the SVI.

Examples

The following example enables IP routing:

```
Router# configure terminal
Router(config)# ip routing
```

ip routing protocol purge interface

To enable routing protocols to purge their routes when an interface goes down in the global configuration mode, use the **ip routing protocol purge interface** command in global configuration mode. To disable this function, use the **no** form of this command.

ip routing protocol purge interface

no ip routing protocol purge interface

Syntax Description

This command has no arguments or keywords.

Command Default

If this command is not executed and a link goes down, the less efficient Routing Information Base (RIB) process is automatically triggered to delete all prefixes from the RIB that have the next hop on this interface. When the process works through a large routing table, it can consume many CPU cycles and increase convergence time.

Command Modes

Global configuration

Command History

Release	Modification
12.0(26)S	This command was introduced.
12.0(27)SV	This command was integrated into Cisco IOS Release 12.0(27)SV.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2 (18)SXE.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2 (25)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2 (28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

The **ip routing protocol purge interface** command enables routing protocols that are capable of responding to interface failures to delete dependent routes from the RIB when a link on a router goes down and the interface is removed from the routing table.

Examples

In the following example, the purge interface function is enabled for a routing protocol.

```
Router# configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# ip routing protocol purge interface
Router(config)# end
```

key

To identify an authentication key on a key chain, use the **key** command in key-chain configuration mode. To remove the key from the key chain, use the **no** form of this command.

key *key-id*

no key *key-id*

Syntax Description

key-id	Identification number of an authentication key on a key chain. The range of keys is from 0 to 2147483647. The key identification numbers need not be consecutive.

Command Default

No key exists on the key chain.

Command Modes

Key-chain configuration

Command History

Release	Modification
11.1	This command was introduced.
12.4(6)T	Support for IPv6 was added.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Only DRP Agent, Enhanced Interior Gateway Routing Protocol (EIGRP), and Routing Information Protocol (RIP) Version 2 use key chains.

It is useful to have multiple keys on a key chain so that the software can sequence through the keys as they become invalid after time, based on the **accept-lifetime** and **send-lifetime** key chain key command settings.

Each key has its own key identifier, which is stored locally. The combination of the key identifier and the interface associated with the message uniquely identifies the authentication algorithm and Message Digest 5 (MD5) authentication key in use. Only one authentication packet is sent, regardless of the number of valid keys. The software starts looking at the lowest key identifier number and uses the first valid key.

If the last key expires, authentication will continue and an error message will be generated. To disable authentication, you must manually delete the last valid key.

To remove all keys, remove the key chain by using the **no key chain** command.

Examples

The following example configures a key chain named chain1. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or a discrepancy in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
interface ethernet 0
 ip rip authentication key-chain chain1
 ip rip authentication mode md5
!
router rip
 network 172.19.0.0
 version 2
!
key chain chain1
 key 1
 key-string key1
 accept-lifetime 13:30:00 Jan 25 1996 duration 7200
 send-lifetime 14:00:00 Jan 25 1996 duration 3600
 key 2
 key-string key2
 accept-lifetime 14:30:00 Jan 25 1996 duration 7200
 send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

Command	Description
accept-lifetime	Sets the time period during which the authentication key on a key chain is received as valid.
ipv6 authentication key-chain eigrp	Enables authentication of EIGRP packets for IPv6.
key chain	Enables authentication for routing protocols.
key-string (authentication)	Specifies the authentication string for a key.
send-lifetime	Sets the time period during which an authentication key on a key chain is valid to be sent.
show key chain	Displays authentication key information.

key chain

To enable authentication for routing protocols, identify a group of authentication keys by using the **key chain** command in global configuration mode. To remove the key chain, use the **no** form of this command.

key chain *name-of-chain*

no key chain *name-of-chain*

Syntax Description

name-of-chain	Name of a key chain. A key chain must have at least one key and can have up to 2147483647 keys.

Command Default

No key chain exists.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.
12.4(6)T	Support for IPv6 was added.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Only DRP Agent, Enhanced Interior Gateway Routing Protocol (EIGRP), and Routing Information Protocol (RIP) Version 2 use key chains.

You must configure a key chain with keys to enable authentication.

Although you can identify multiple key chains, we recommend using one key chain per interface per routing protocol. Upon specifying the **key chain** command, you enter key-chain configuration mode.

Examples

The following example configures a key chain named chain1. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or a discrepancy in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
interface ethernet 0
 ip rip authentication key-chain chain1
 ip rip authentication mode md5
!
router rip
 network 172.19.0.0
```

```
 version 2
!
key chain chain1
 key 1
 key-string key1
 accept-lifetime 13:30:00 Jan 25 1996 duration 7200
 send-lifetime 14:00:00 Jan 25 1996 duration 3600
  key 2
  key-string key2
  accept-lifetime 14:30:00 Jan 25 1996 duration 7200
  send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

Command	Description
accept-lifetime	Sets the time period during which the authentication key on a key chain is received as valid.
ip rip authentication key-chain	Enables authentication for RIP Version 2 packets and specifies the set of keys that can be used on an interface.
ipv6 authentication key-chain eigrp	Enables authentication of EIGRP packets for IPv6.
key	Identifies an authentication key on a key chain.
key-string (authentication)	Specifies the authentication string for a key.
send-lifetime	Sets the time period during which an authentication key on a key chain is valid to be sent.
show key chain	Displays authentication key information.

key-string (authentication)

To specify the authentication string for a key, use the **key-string** command in key chain key configuration mode. To remove the authentication string, use the **no** form of this command.

key-string *text*

no key-string *text*

Syntax Description

text	Authentication string that must be sent and received in the packets using the routing protocol being authenticated. The string can contain from 1 to 80 uppercase and lowercase alphanumeric characters, except that the first character cannot be a number.

Command Default

No key exists.

Command Modes

Key chain key configuration

Command History

Release	Modification
11.1	This command was introduced.
12.4(6)T	Support for IPv6 was added.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Only DRP Agent, Enhanced Interior Gateway Routing Protocol (EIGRP), and Routing Information Protocol (RIP) Version 2 use key chains. Each key can have only one key string.

If password encryption is configured (with the **service password-encryption** command), the software saves the key string as encrypted text. When you write to the terminal with the **more system:running-config** command, the software displays key-string 7 encrypted text.

Examples

The following example configures a key chain named chain1. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or a discrepancy in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
interface ethernet 0
 ip rip authentication key-chain chain1
 ip rip authentication mode md5
!
router rip
 network 172.19.0.0
 version 2
```

```
!
key chain chain1
 key 1
 key-string key1
 accept-lifetime 13:30:00 Jan 25 1996 duration 7200
 send-lifetime 14:00:00 Jan 25 1996 duration 3600
 key 2
 key-string key2
 accept-lifetime 14:30:00 Jan 25 1996 duration 7200
 send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

Command	Description
accept-lifetime	Sets the time period during which the authentication key on a key chain is received as valid.
ipv6 authentication key-chain eigrp	Enables authentication of EIGRP packets for IPv6.
key	Identifies an authentication key on a key chain.
key chain	Enables authentication for routing protocols.
send-lifetime	Sets the time period during which an authentication key on a key chain is valid to be sent.
service password-encryption	Encrypts passwords.
show key chain	Displays authentication key information.

match interface (IP)

To distribute any routes that have their next hop out one of the interfaces specified, use the **match interface** command in route-map configuration mode. To remove the **match interface** entry, use the **no** form of this command.

match interface *interface-type interface-number* [*... interface-type interface-number*]

no match interface *interface-type interface-number* [*... interface-type interface-number*]

Syntax Description

interface-type	Interface type.
interface-number	Interface number.

Defaults

No match interfaces are defined.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *interface-type interface-number* arguments.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands may be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

A route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure a second route map section with an explicit match specified.

Examples

In the following example, routes that have their next hop out Ethernet interface 0 will be distributed:

```
route-map name
 match interface ethernet 0
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

match ip address

To distribute 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 to perform policy routing on packets, use the **match ip address** command in route-map configuration mode. To remove the **match ip address** entry, use the **no** form of this command.

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...*]}

no 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...*]}

Syntax Description

access-list-number...	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.
access-list-name...	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.
prefix-list	Distributes routes based on a prefix list.
prefix-list-name...	Name of a specific prefix list. The ellipsis indicates that multiple values can be entered.

Defaults

No access list numbers or prefix lists are specified.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *access-list-number, access-list-name, or prefix-list-name* arguments.

Like matches in the same route map subblock are filtered with “or” semantics. If any one match clause is matched in the entire route map subblock, this match is treated as a successful match. Dissimilar match clauses are filtered with “and” semantics. So dissimilar matches are filtered logically. If the first set of conditions is not met, the second match clause is filtered. This process continues until a match occurs or there are no more match clauses.

Use route maps to redistribute routes or to subject packets to policy routing. Both purposes are described in this section.

Redistribution

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

When you are passing routes through a route map, a route map can have several sections that contain specific **match** clauses. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure a second route map section with an explicit match specified.

Policy Routing

Another purpose of route maps is to enable policy routing. The **match ip address** command allows you to policy route packets based on criteria that can be matched with an extended access list; for example, a protocol, protocol service, and source or destination IP address. To define the conditions for policy routing packets, use the **ip policy route-map** interface configuration command, in addition to the **route-map** global configuration command, and the **match** and **set** route-map configuration commands. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing occurs. The **set** commands specify the *set actions*—the particular routing actions to perform if the criteria enforced by the **match** commands are met. You might want to policy route packets based on their source, for example, using an access list.

Examples

In the following example, routes that have addresses specified by access list numbers 5 or 80 will be matched:

```
route-map name
 match ip address 5 80
```

Route maps that use prefix lists can be used for route filtering, default origination, and redistribution in other routing protocols. In the following example, a default route 0.0.0.0/0 is conditionally originated when there exists a prefix 10.1.1.0/24 in the routing table:

```
ip prefix-list cond permit 10.1.1.0/24
!
route-map default-condition permit 10
match ip address prefix-list cond
!
router rip
default-information originate route-map default-condition
!
```

In the following policy routing example, packets that have addresses specified by access list numbers 6 or 25 will be routed to Ethernet interface 0:

```
interface serial 0
 ip policy route-map chicago
!
route-map chicago
 match ip address 6 25
 set interface ethernet 0
```

Related Commands

Command	Description
ip local policy route-map	Identifies a route map to use for policy routing on an interface.
ip policy route-map	Identifies a route map to use for policy routing on an interface.
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match length	Bases policy routing on the Level 3 length of a packet.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of a route map for policy routing.
set ip default next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.

Command	Description
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

match ip next-hop

To redistribute any routes that have a next hop router address passed by one of the access lists specified, use the **match ip next-hop** command in route-map configuration mode. To remove the next hop entry, use the **no** form of this command.

match ip next-hop {*access-list-number* | *access-list-name*} [*...access-list-number* | *...access-list-name*]

no match ip next-hop {*access-list-number* | *access-list-name*} [*...access-list-number* | *...access-list-name*]

Syntax Description

access-list-number | *access-list-name*	Number or name of a standard or extended access list. It can be an integer from 1 to 199.

Defaults

Routes are distributed freely, without being required to match a next hop address.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *access-list-number* or *access-list-name* argument.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

When you are passing routes through a route map, a route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure a second route map section with an explicit match specified.

Examples

The following example distributes routes that have a next hop router address passed by access list 5 or 80 will be distributed:

```
route-map name
 match ip next-hop 5 80
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

match ip route-source

To redistribute routes that have been advertised by routers and access servers at the address specified by the access lists, use the **match ip route-source** command in route-map configuration mode. To remove the route-source entry, use the **no** form of this command.

match ip route-source {*access-list-number* | *access-list-name*} [*...access-list-number* | *...access-list-name*]

no match ip route-source {*access-list-number* | *access-list-name*} [*...access-list-number* | *...access-list-name*]

Syntax Description

access-list-number | *access-list-name*	Number or name of a standard or extended access list. It can be an integer from 1 to 199.

Defaults

No filtering on route source.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *access-list-number* or *access-list-name* argument.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

A route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure second route map section with an explicit match specified.

There are situations in which the next hop and source router address of the route are not the same.

Examples

The following example distributes routes that have been advertised by routers and access servers at the addresses specified by access lists 5 and 80:

```
route-map name
 match ip route-source 5 80
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

match length

To base policy routing on the Level 3 length of a packet, use the **match length** command in route-map configuration mode. To remove the entry, use the **no** form of this command.

match length *minimum-length maximum-length*

no match length *minimum-length maximum-length*

Syntax Description

minimum-length	Minimum Level 3 length of the packet, inclusive, allowed for a match. Range is from 0 to 0x7FFFFFFF.
maximum-length	Maximum Level 3 length of the packet, inclusive, allowed for a match. Range is from 0 to 0x7FFFFFFF.

Command Default

No policy routing occurs on the length of a packet.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.3(7)T	This command was updated for use in configuring IPv6 policy-based routing (PBR).
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

In IPv4, use the **ip policy route-map** interface configuration command, the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for policy routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing occurs. The **set** commands specify the *set actions*—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

In PBR for IPv6, use the **ipv6 policy route-map** or **ipv6 local policy route-map** command to define conditions for policy routing packets.

In IPv4, the **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the packet to be routed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

In IPv4, you might want to base your policy routing on the length of packets so that your interactive traffic and bulk traffic are directed to different routers.

Examples

In the following example, packets 3 to 200 bytes long, inclusive, will be routed to FDDI interface 0:

```
interface serial 0
 ip policy route-map interactive
!
route-map interactive
 match length 3 200
 set interface fddi 0
```

In the following example for IPv6, packets 3 to 200 bytes long, inclusive, will be routed to FDDI interface 0:

```
interface Ethernet0/0
  ipv6 policy-route-map interactive
!
route-map interactive
 match length 3 200
 set interface fddi 0
```

Related Commands

Command	Description
ip local policy route-map	Identifies a route map to use for policy routing on an interface.
ipv6 local policy route-map	Configures PBR for IPv6 for originated packets.
ipv6 policy route-map	Configures IPv6 PBR on an interface.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ipv6 address	Specifies an IPv6 access list to use to match packets for PBR for IPv6.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip default next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ipv6 default next-hop	Specifies an IPv6 default next hop to which matching packets will be forwarded.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.
set ipv6 next-hop (PBR)	Indicates where to output IPv6 packets that pass a match clause of a route map for policy routing.
set ipv6 precedence	Sets the precedence value in the IPv6 packet header.

match metric (IP)

To redistribute routes with the specified metric, use the **match metric** command in route-map configuration mode. To remove the entry for the redistributed route from the routing table, use the **no** form of this command.

match metric {*metric-value* | **external** *metric-value*} [**+-** *deviation-number*]

no match metric {*metric-value* | **external** *metric-value*} [**+-** *deviation-number*]

Syntax Description

metric-value	Internal route metric, which can be an Enhanced Interior Gateway Routing Protocol (EIGRP) five-part metric. The range is from 1 to 4294967295.
external	External protocol associated with a route and interpreted by a source protocol.
+- *deviation-number*	(Optional) A standard deviation number that will offset the number configured for the *metric-value* argument. The *deviation-number* argument can be any number. There is no default. **Note** When you specify a deviation of the metric with the **+** and **-** keywords, the router will match any metric that falls inclusively in that range.

Command Default

No filtering is performed on a metric value.

Command Modes

Route-map configuration

Command History

Release	Modification
11.2	This command was introduced.
12.3(8)T	The **external** and **+-** keywords and *deviation-number* argument were added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.

Usage Guidelines

Use the **route-map** global configuration command and the **match** and **set** route-map configuration commands to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the set actions given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

A route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure a second route map section with an explicit match specified.

Note An external protocol route metric is not the same as the EIGRP assigned route metric which is a figure computed using EIGRP vectorized metric components (delay, bandwidth, reliability, load, and MTU).

Examples

In the following example, routes with the metric 5 will be redistributed:

```
route-map name
 match metric 5
```

In the following example, any metric that falls inclusively in the range from 400 to 600 is matched:

```
route-map name
 match metric 500 +- 100
```

The following example shows how to configure a route map to match an EIGRP external protocol metric route with an allowable deviation of 100, a source protocol of BGP, and an autonomous system 45000. When the two match clauses are true, the tag value of the destination routing protocol is set to 5. The route map is used to distribute incoming packets for an EIGRP process.

```
route-map metric_range
 match metric external 500 +- 100
 match source-protocol bgp 45000
 set tag 5
!
router eigrp 45000
 network 172.16.0.0
 distribute-list route-map metric_range in
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.

Command	Description
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.

match route-type (IP)

To redistribute routes of the specified type, use the **match route-type** command in route-map configuration mode. To remove the route type entry, use the **no** form of this command.

match route-type {**local** | **internal** | **external** [**type-1** | **type-2**] | **level-1** | **level-2**}

no match route-type {**local** | **internal** | **external** [**type-1** | **type-2**] | **level-1** | **level-2**}

Syntax Description

local	Locally generated Border Gateway Protocol (BGP) routes.
internal	Open Shortest Path First (OSPF) intra-area and interarea routes or Enhanced Interior Gateway Routing Protocol (EIGRP) internal routes.
external [**type-1** | **type-2**]	OSPF external routes, or EIGRP external routes. For OSPF, the **external type-1** keyword matches only Type 1 external routes and the **external type-2** keyword matches only Type 2 external routes.
level-1	Intermediate System-to-Intermediate System (IS-IS) Level 1 routes.
level-2	IS-IS Level 2 routes.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
11.2	The **local** and **external** [**type-1** | **type-2**] keywords were added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

A route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure second route map section with an explicit match specified.

Examples

The following example redistributes internal routes:

```
route-map name
 match route-type internal
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

match tag

To redistribute routes in the routing table that match the specified tags, use the **match tag** command in route-map configuration mode. To remove the tag entry, use the **no** form of this command.

match tag *tag-value* [*...tag-value*]

no match tag *tag-value* [*...tag-value*]

Syntax Description

tag-value	List of one or more route tag values. Each can be an integer from 0 to 4294967295.

Command Default

No match tag values are defined.

Command Modes

Route-map configuration (config-route-map)

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 Series Aggregation Services Routers.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *tag-value* argument.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

A route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure a second route map section with an explicit match specified.

Examples

The following example redistributes routes stored in the routing table with tag 5:

```
Router(config)# route-map name
Router(config-route-map)# match tag 5
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
route-map	Defines the conditions for redistributing routes from one routing protocol into another.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

maximum-paths

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

maximum-paths *number-paths*

no maximum-paths

Syntax Description

number-paths	Maximum number of parallel routes that an IP routing protocol installs in a routing table. Valid values vary by Cisco IOS release and platform. For more information on valid values, use the question mark (**?**) online help function.

Command Default

The default number of parallel routes vary by Cisco IOS release and platform.

Command Modes

Router address family topology configuration (config-router-af-topology)
Router configuration (config-router)

Command History

Release	Modification
12.2(8)T	This command was introduced.
12.2(14)SX	This command was implemented on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Cisco IOS Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was made available in router address family topology configuration mode.
12.2(33)SXH	The maximum number of paths was changed from 8 to 16 for Cisco IOS Release 12.2(33)SXH.

Usage Guidelines

Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **maximum-paths** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

Examples

The following example shows how to allow a maximum of 16 paths to a destination for an OSPF routing process:

```
Router(config)# router ospf 3
Router(config-router)# maximum-paths 16
```

nsf

To enable and configure Cisco NSF, use the **nsf** command in router configuration mode. To disable NSF, uses the **no** form of this command.

nsf [**enforce global**]

nsf [{**cisco** | **ietf**} | **interface wait** *seconds* | **interval** *minutes* | **t3** [**adjacency** | **manual** *seconds*]]

no nsf

Syntax Description

enforce global	(Optional) Cancels OSPF NSF restart when non-NSF-aware neighbors are detected.
cisco	Specifies the Cisco proprietary IS-IS NSF method of checkpointing if the active RP fails over.
ietf	Specifies the IETF IS-IS NSF method of protocol modification if the active RP fails over.
interface wait *seconds*	(Optional) Specifies how long to wait for an interface to come up after failover before it proceeds with the Cisco NSF process; valid values are from 1 to 60 seconds.
interval *minutes*	(Optional) Specifies how long to wait after a route processor stabilizes before restarting; valid values are from 0 to 1440 minutes.
t3 adjacency	(Optional) Specifies that the time that IETF NSF waits for the LSP database to synchronize is determined by the adjacency holdtime advertised to the neighbors of the specified RP before switchover.
t3 manual *seconds*	(Optional) Specifies the time to wait after the NSF database synchronizes before informing other nodes to remove the restarting node from consideration as a transit; valid values are from 5 to 3600 seconds.

Defaults

The default settings are as follows:

- NSF is disabled.
- **enforce global**—Enabled.
- **interval** *minutes*—5 minutes.
- **interface wait** *seconds*—10 seconds.
- **t3 manual** *seconds*—30 seconds.

Command Modes

Router configuration

Command History

Release	Modification
12.2(18)SXD	Support for this command was introduced on the Supervisor Engine 720.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

The **nsf** command is not supported on Cisco 7600 series routers that are configured with a Supervisor Engine 2.

The **nsf interface wait** command can be used if Cisco proprietary IS-IS NSF is configured or if the Internet Engineering Task Force (IETF) IS-IS NSF is enabled using the **nsf t3** manual command. You can use this command if an interface is slow to come up.

Note Cisco NSF is required only if the Cisco 7600 series router is expected to perform Cisco NSF during a restart. If the Cisco 7600 series router is expected to cooperate with a neighbor that is doing a Cisco NSF restart only, the switch must be NSF capable by default (running a version of code that supports Cisco NSF), but Cisco NSF does not have to be configured on the switch.

The **nsf** commands are a subset of the **router** command and affects all the interfaces that are covered by the designated process. Cisco NSF supports the BGP, OSPF, IS-IS, and EIGRP protocols. The configuration commands that enable NSF processing are as follows:

- **nsf** under the **router ospf** command
- **nsf ietf** under the **router isis** command
- **bgp graceful-restart** under the **router bgp** command

These commands must be issued as part of the router's running configuration. During the restart, these commands are restored to activate the NSF processing.

The [{**cisco** | **ietf**} | **interface wait** *seconds* | **interval** *minutes* | **t3** [**adjacency** | **manual** *seconds*] keywords and arguments apply to IS-IS only.

The {**enforce global**} keywords apply to OSPF only.

BGP NSF Guidelines

BGP support in NSF requires that neighbor networking devices be NSF-aware devices; that is, they must have the graceful restart capability and advertise that capability in the OPEN message during session establishment. If an NSF-capable router discovers that a particular BGP neighbor does not have the graceful restart capability enabled, it will not establish an NSF-capable session with that neighbor. All other neighbors that have a graceful restart capability will continue to have NSF-capable sessions with this NSF-capable networking device. Enter the **bgp graceful-restart** router configuration command to enable the graceful restart capability.

EIRGP NSF Guidelines

A router may be an NSF-aware router but may not be participating in helping out the NSF restarting neighbor because it is coming up from a cold start.

IS-IS NSF Guidelines

If you configure IETF on the networking device, but neighbor routers are not IETF-compatible, NSF will abort after the switchover.

Use these two keywords when configuring IS-IS NSF:

- **ietf**—Internet Engineering Task Force IS-IS—After a supervisor engine switchover, the NSF-capable router sends the IS-IS NSF restart requests to the neighboring NSF-aware devices.
- **cisco**—Cisco IS-IS. Full adjacency and LSP information is saved (checkpointed) to the standby supervisor engine. After a switchover, the newly active supervisor engine maintains its adjacencies using the checkpointed data to quickly rebuild its routing tables.

OSPF NSF Guidelines

OSPF NSF requires that all neighbor networking devices be NSF-aware devices. If an NSF-capable router discovers that it has non-NSF aware neighbors on a particular network segment, it will disable the NSF capabilities for that segment. The other network segments that are composed entirely of NSF-capable or NSF-aware routers will continue to provide NSF capabilities.

OSPF NSF supports NSF/SSO for IPv4 traffic only. OSPFv3 is not supported with NSF/SSO. Only OSPFv2 is supported with NSF/SSO.

Examples

This example shows how to enable NSF for all OSPF-process interfaces:

```
Router(config)# router ospf 109
Router(config-router)# nsf
```

This example shows how to disable NSF for all OSPF-process interfaces:

```
Router(config)# router ospf 109
Router(config-router)# no nsf
```

Related Commands

Command	Description
router	Enables a routing process.

passive-interface

To disable sending routing updates on an interface, use the **passive-interface** command in router configuration mode. To re-enable the sending of routing updates, use the **no** form of this command.

passive-interface [**default**] i*nterface-type interface-number*

no passive-interface *interface-type interface-number*

Syntax Description

default	(Optional) Causes all interfaces to become passive.
interface-type	Interface type.
interface-number	Interface number.

Defaults

Routing updates are sent on the interface.

Command Modes

Router configuration (config-router)

Command History

Release	Modification
10.0	This command was introduced.
12.0	This command was modified. The **default** keyword was added.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
Cisco IOS XE Release 2.1	This command was integrated into Cisco IOS XE Release 2.1.

Usage Guidelines

If you disable the sending of routing updates on an interface, the particular subnet will continue to be advertised to other interfaces, and updates from other routers on that interface continue to be received and processed.

The **default** keyword sets all interfaces as passive by default. You can then configure individual interfaces where adjacencies are desired using the **no passive-interface** command. The **default** keyword is useful in Internet service provider (ISP) and large enterprise networks where many of the distribution routers have more than 200 interfaces.

For the Open Shortest Path First (OSPF) protocol, OSPF routing information is neither sent nor received through the specified router interface. The specified interface address appears as a stub network in the OSPF domain.

For the Intermediate System-to-Intermediate System (IS-IS) protocol, this command instructs IS-IS to advertise the IP addresses for the specified interface without actually running IS-IS on that interface. The **no** form of this command for IS-IS disables advertising IP addresses for the specified address.

Note For IS-IS you must keep at least one active interface and configure the interface with the **ip router isis** command.

The use of the **passive-interface** command in Enhanced Interior Gateway Routing Protocol (EIGRP) suppresses the exchange of hello packets on the interface and thus stops routing updates from being advertised, and it also suppresses incoming routing updates. For more information on passive interfaces, see http://www.cisco.com/en/US/tech/tk365/technologies_tech_note09186a0080093f0a.shtml.

Examples

The following example sends EIGRP updates to all interfaces on network 10.108.0.0 except Ethernet interface 1:

```
router eigrp 109
 network 10.108.0.0
 passive-interface ethernet 1
```

The following configuration enables IS-IS on Ethernet interface 1 and serial interface 0 and advertises the IP addresses of Ethernet interface 0 in its link-state protocol data units (PDUs):

```
router isis Finance
 passive-interface Ethernet 0
interface Ethernet 1
 ip router isis Finance
interface serial 0
 ip router isis Finance
```

The following example sets all interfaces as passive and then activates Ethernet interface 0:

```
router ospf 100
 passive-interface default
 no passive-interface ethernet0
 network 10.108.0.1 0.0.0.255 area 0
```

redistribute (IP)

To redistribute routes from one routing domain into another routing domain, use the **redistribute** command in the appropriate configuration mode. To disable redistribution, use the **no** form of this command.

redistribute *protocol* [*process-id*] {**level-1** | **level-1-2** | **level-2**} [*autonomous-system-number*] [**metric** {*metric-value* | **transparent**}] [**metric-type** *type-value*] [**match** {**internal** | **external 1** | **external 2**}] [**tag** *tag-value*] [**route-map** *map-tag*] [**subnets**] [**nssa-only**]

no redistribute *protocol* [*process-id*] {**level-1** | **level-1-2** | **level-2**} [*autonomous-system-number*] [**metric** {*metric-value* | **transparent**}] [**metric-type** *type-value*] [**match** {**internal** | **external 1** | **external 2**}] [**tag** *tag-value*] [**route-map** *map-tag*] [**subnets**] [**nssa-only**]

Syntax Description

protocol	Source protocol from which routes are being redistributed. It can be one of the following keywords: **bgp**, **connected**, **eigrp**, **isis**, **mobile**, **ospf**, **static** [**ip**], or **rip**. The **static** [**ip**] keyword is used to redistribute IP static routes. The optional **ip** keyword is used when redistributing into the Intermediate System-to-Intermediate System (IS-IS) protocol. The **connected** keyword refers to routes that are established automatically by virtue of having enabled IP on an interface. For routing protocols such as Open Shortest Path First (OSPF) and IS-IS, these routes will be redistributed as external to the autonomous system.
process-id	(Optional) For the **bgp** or **eigrp** keyword, this is an autonomous system number, which is a 16-bit decimal number. For the **isis** keyword, this is an optional *tag* value that defines a meaningful name for a routing process. You can specify only one IS-IS process per router. Creating a name for a routing process means that you use names when configuring routing. For the **ospf** keyword, this is an appropriate OSPF process ID from which routes are to be redistributed. This identifies the routing process. This value takes the form of a nonzero decimal number. For the **rip** keyword, no *process-id* value is needed. By default, no process ID is defined.
level-1	Specifies that, for IS-IS, Level 1 routes are redistributed into other IP routing protocols independently.
level-1-2	Specifies that, for IS-IS, both Level 1 and Level 2 routes are redistributed into other IP routing protocols.
level-2	Specifies that, for IS-IS, Level 2 routes are redistributed into other IP routing protocols independently.

autonomous-system-number	(Optional) Autonomous system number for the redistributed route. Number in the range from 1 to 65535. • In Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SXI1, Cisco IOS XE Release 2.4, and later releases, 4-byte autonomous system numbers are supported in the range from 65536 to 4294967295 in asplain notation and in the range from 1.0 to 65535.65535 in asdot notation. • In Cisco IOS Release 12.0(32)S12, 12.4(24)T, and Cisco IOS XE Release 2.3, 4-byte autonomous system numbers are supported in the range from 1.0 to 65535.65535 in asdot notation only. For more details about autonomous system number formats, see the **router bgp** command.
metric *metric-value*	(Optional) When redistributing from one OSPF process to another OSPF process on the same router, the metric will be carried through from one process to the other if no metric value is specified. When redistributing other processes to an OSPF process, the default metric is 20 when no metric value is specified. The default value is 0.
metric transparent	(Optional) Causes RIP to use the routing table metric for redistributed routes as the RIP metric.
metric-type *type-value*	(Optional) For OSPF, specifies the external link type associated with the default route advertised into the OSPF routing domain. It can be one of two values: • **1**—Type 1 external route • **2**—Type 2 external route If a **metric-type** is not specified, the Cisco IOS software adopts a Type 2 external route. For IS-IS, it can be one of two values: • **internal**—IS-IS metric that is < 63. • **external**—IS-IS metric that is > 64 < 128. The default is **internal**.
match {**internal** | **external 1** | **external 2**}	(Optional) For the criteria by which OSPF routes are redistributed into other routing domains. It can be one of the following: • **internal**—Routes that are internal to a specific autonomous system. • **external 1**—Routes that are external to the autonomous system, but are imported into OSPF as Type 1 external route. • **external 2**—Routes that are external to the autonomous system, but are imported into OSPF as Type 2 external route. The default is internal and external 1.

tag *tag-value*	(Optional) Specifies the 32-bit decimal value attached to each external route. This is not used by OSPF itself. It may be used to communicate information between Autonomous System Boundary Routers (ASBRs). If none is specified, then the remote autonomous system number is used for routes from Border Gateway Protocol (BGP) and Exterior Gateway Protocol (EGP); for other protocols, zero (0) is used.
route-map	(Optional) Specifies the route map that should be interrogated to filter the importation of routes from this source routing protocol to the current routing protocol. If not specified, all routes are redistributed. If this keyword is specified, but no route map tags are listed, no routes will be imported.
map-tag	(Optional) Identifier of a configured route map.
subnets	(Optional) For redistributing routes into OSPF, the scope of redistribution for the specified protocol. By default, no subnets are defined.
nssa-only	(Optional) Sets the nssa-only attribute for all routes redistributed into OSPF.

Command Default

Route redistribution is disabled.

Command Modes

Router configuration (config-router)
Address family configuration (config-af)
Address family topology configuration (config-router-af-topology)

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	This command was modified. Address family configuration mode was added.
12.0(22)S	This command was modified. Address family support under EIGRP was added.
12.2(15)T	This command was modified. Address family support under EIGRP was added.
12.2(18)S	This command was modified. Address family support under EIGRP was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was modified. This command was made available in router address family topology configuration mode.
12.2(14)SX	This command was integrated into Cisco IOS Release 12.2(14)SX.
12.0(32)S12	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
12.0(32)SY8	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.

Release	Modification
12.4(24)T	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
Cisco IOS XE Release 2.3	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
12.2(33)SXI1	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.
12.0(33)S3	This command was modified. Support for asplain notation was added and the default format for 4-byte autonomous system numbers is asplain.
Cisco IOS XE Release 2.4	This command was modified. Support for asplain notation was added and the default format for 4-byte autonomous system numbers is asplain.
Cisco IOS Release 15.0(1)M	This command was modified. The **nssa-only** keyword was added.
12.2(33)SRE	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.
12.2(33)XNE	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.

Usage Guidelines

Changing or disabling any keyword will not affect the state of other keywords.

A router receiving a link-state protocol with an internal metric will consider the cost of the route from itself to the redistributing router plus the advertised cost to reach the destination. An external metric only considers the advertised metric to reach the destination.

Routes learned from IP routing protocols can be redistributed at Level 1 into an attached area or at Level 2. The **level-1-2** keyword allows both Level 1 and Level 2 routes in a single command.

Redistributed routing information must be filtered by the **distribute-list out** router configuration command. This guideline ensures that only those routes intended by the administrator are passed along to the receiving routing protocol.

Whenever you use the **redistribute** or the **default-information** router configuration commands to redistribute routes into an OSPF routing domain, the router automatically becomes an ASBR. However, an ASBR does not, by default, generate a *default route* into the OSPF routing domain.

When routes are redistributed into OSPF from protocols other than OSPF or BGP, and no metric has been specified with the **metric-type** keyword and *type-value* argument, OSPF will use 20 as the default metric. When routes are redistributed into OSPF from BGP, OSPF will use 1 as the default metric. When routes are redistributed from one OSPF process to another OSPF process, Autonomous system (AS) external and not-so-stubby-area (NSSA) routes will use 20 as the default metric. When intra-area and inter-area routes are redistributed between OSPF processes, the internal OSPF metric from the redistribution source process is advertised as the external metric in the redistribution destination process. (This is the only case in which the routing table metric will be preserved when routes are redistributed into OSPF.)

When routes are redistributed into OSPF, only routes that are not subnetted are redistributed if the **subnets** keyword is not specified.

On a router internal to an NSSA area, the **nssa-only** keyword causes the originated type-7 NSSA LSAs to have their propagate (P) bit set to zero, which prevents area border routers from translating these LSAs into type-5 external LSAs. On an area border router that is connected to a NSSA and normal areas, the **nssa-only** keyword causes the routes to be redistributed only into the NSSA areas.

Routes configured with the **connected** keyword affected by this **redistribute** command are the routes not specified by the **network** router configuration command.

You cannot use the **default-metric** command to affect the metric used to advertise connected routes.

Note The **metric** value specified in the **redistribute** command supersedes the **metric** value specified using the **default-metric** command.

Default redistribution of IGPs or EGP into BGP is not allowed unless the **default-information originate** router configuration command is specified.

Using the no Form of the redistribute Command

Removing options that you have configured for the **redistribute** command requires careful use of the **no** form of the **redistribute** command to ensure that you obtain the result that you are expecting. See the "Examples" section for more information.

Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **redistribute** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

4-Byte Autonomous System Number Support

In Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SXI1, Cisco IOS XE Release 2.4, and later releases, the Cisco implementation of 4-byte autonomous system numbers uses asplain—65538 for example—as the default regular expression match and output display format for autonomous system numbers, but you can configure 4-byte autonomous system numbers in both the asplain format and the asdot format as described in RFC 5396. To change the default regular expression match and output display of 4-byte autonomous system numbers to asdot format, use the **bgp asnotation dot** command.

In Cisco IOS Release 12.0(32)S12, 12.4(24)T, and Cisco IOS XE Release 2.3, the Cisco implementation of 4-byte autonomous system numbers uses asdot—1.2, for example—as the only configuration format, regular expression match, and output display, with no asplain support.

Examples

The following example shows how OSPF routes are redistributed into a BGP domain:

```
Router(config)# router bgp 109
Router(config-router)# redistribute ospf
```

The following example causes EIGRP routes to be redistributed into an OSPF domain:

```
Router(config)# router ospf 110
Router(config-router)# redistribute eigrp
```

The following example causes the specified EIGRP process routes to be redistributed into an OSPF domain. The EIGRP-derived metric will be remapped to 100 and RIP routes to 200.

```
Router(config)# router ospf 109
Router(config-router)# redistribute eigrp 108 metric 100 subnets
Router(config-router)# redistribute rip metric 200 subnets
```

The following example configures BGP routes to be redistributed into IS-IS. The link-state cost is specified as 5, and the metric type will be set to external, indicating that it has lower priority than internal metrics.

```
Router(config)# router isis
Router(config-router)# redistribute bgp 120 metric 5 metric-type external
```

In the following example, network 172.16.0.0 will appear as an external link-state advertisement (LSA) in OSPF 1 with a cost of 100 (the cost is preserved):

```
Router(config)# interface ethernet 0
Router(config-if)# ip address 172.16.0.1 255.0.0.0
Router(config)# ip ospf cost 100
Router(config)# interface ethernet 1
Router(config-if)# ip address 10.0.0.1 255.0.0.0
!
Router(config)# router ospf 1
Router(config-router)# network 10.0.0.0 0.255.255.255 area 0
Router(config-router)# redistribute ospf 2 subnet
Router(config)# router ospf 2
Router(config-router)# network 172.16.0.0 0.255.255.255 area 0
```

The following example shows how BGP routes are redistributed into OSPF and assigned the local 4-byte autonomous system number in asplain format. This example requires Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)SXI1, Cisco IOS XE Release 2.4, or a later release.

```
Router(config)# router ospf 2
Router(config-router)# redistribute bgp 65538
```

The following example removes the **connected metric 1000 subnets** options from the **redistribute connected metric 1000 subnets** command and leaves the **redistribute connected** command in the configuration:

```
Router(config-router)# no redistribute connected metric 1000 subnets
```

The following example removes the **metric 1000** options from the **redistribute connected metric 1000 subnets** command and leaves the **redistribute connected subnets** command in the configuration:

```
Router(config-router)# no redistribute connected metric 1000
```

The following example removes the **subnets** options from the **redistribute connected metric 1000 subnets** command and leaves the **redistribute connected metric 1000** command in the configuration:

```
Router(config-router)# no redistribute connected subnets
```

The following example removes the **redistribute connected** command, and any of the options that were configured for the **redistribute connected** command, from the configuration:

```
Router(config-router)# no redistribute connected
```

The following example shows how EIGRP routes are redistributed into an EIGRP process in a named EIGRP configuration:

```
Router(config)# router eigrp virtual-name
Router(config-router)# address-family ipv4 autonomous-system 1
Router(config-router-af)# topology base
Router(config-router-af-topology)# redistribute eigrp 6473 metric 1 1 1 1 1
```

Related Commands

Command	Description
address-family (EIGRP)	Enters address-family configuration mode to configure an EIGRP routing instance.
address-family ipv4 (BGP)	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IPv4 address prefixes.

Command	Description
address-family vpnv4	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPNv4 address prefixes.
bgp asnotation dot	Changes the default display and the regular expression match format of BGP 4-byte autonomous system numbers from asplain (decimal values) to dot notation.
default-information originate (BGP)	Allows the redistribution of network 0.0.0.0 into BGP.
default-information originate (IS-IS)	Generates a default route into an IS-IS routing domain.
default-information originate (OSPF)	Generates a default route into an OSPF routing domain.
distribute-list out (IP)	Suppresses networks from being advertised in updates.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
router bgp	Configures the BGP routing process.
router eigrp	Configures the EIGRP address-family process.
show route-map	Displays all route maps configured or only the one specified.
topology (EIGRP)	Configures an EIGRP process to route IP traffic under the specified topology instance and enters address family topology configuration mode.

route-map

To define the conditions for redistributing routes from one routing protocol into another routing protocol, or to enable policy routing, use the **route-map** command in global configuration mode and the **match** and **set** commands in route-map configuration modes. To delete an entry, use the **no** form of this command.

route-map *map-tag* [**permit** | **deny**] [*sequence-number*]

no route-map *map-tag* [**permit** | **deny**] [*sequence-number*]

Syntax Description

map-tag	A meaningful name for the route map. The **redistribute** router configuration command uses this name to reference this route map. Multiple route maps may share the same map tag name.
permit	(Optional) If the match criteria are met for this route map, and the **permit** keyword is specified, the route is redistributed as controlled by the set actions. In the case of policy routing, the packet is policy routed. If the match criteria are not met, and the **permit** keyword is specified, the next route map with the same map tag is tested. If a route passes none of the match criteria for the set of route maps sharing the same name, it is not redistributed by that set.
deny	(Optional) If the match criteria are met for the route map and the **deny** keyword is specified, the route is not redistributed. In the case of policy routing, the packet is not policy routed, and no further route maps sharing the same map tag name will be examined. If the packet is not policy routed, the normal forwarding algorithm is used.
sequence-number	(Optional) Number that indicates the position a new route map will have in the list of route maps already configured with the same name. If used with the **no** form of this command, the position of the route map should be deleted.

Command Default

Policy routing is not enabled and conditions for redistributing routes from one routing protocol into another routing protocol are not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
10.0	This command was introduced.
12.3(7)T	This command was updated for use in configuring IPv6 policy-based routing (PBR).
12.2(25)SG	This command was integrated into Cisco IOS Release 12.2(25)SG.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 Series Aggregation Services Routers.

Usage Guidelines

Use the **route-map** command to enter route-map configuration mode.

Use route maps to redistribute routes or to subject packets to policy routing. Both purposes are described in this section.

Redistribution

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be given in any order, and all **match** commands must "pass" to cause the route to be redistributed according to the *set actions* given with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

Use route maps when you want detailed control over how routes are redistributed between routing processes. The destination routing protocol is the one you specify with the **router** global configuration command. The source routing protocol is the one you specify with the **redistribute** router configuration command. See the "Examples" section for an illustration of how route maps are configured.

When you are passing routes through a route map, a route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure a second route map section with an explicit match specified.

Policy Routing

Another purpose of route maps is to enable policy routing. Use the **ip policy route-map** or **ipv6 policy route-map** command, in addition to the **route-map** command, and the **match** and **set** commands to define the conditions for policy routing packets. The **match** commands specify the conditions under which policy routing occurs. The **set** commands specify the routing actions to perform if the criteria enforced by the **match** commands are met. You might want to policy route packets some way other than the obvious shortest path.

The *sequence-number* argument works as follows:

1. If no entry is defined with the supplied tag, an entry is created with the *sequence-number* argument set to 10.
2. If only one entry is defined with the supplied tag, that entry becomes the default entry for the following **route-map** command. The *sequence-number* argument of this entry is unchanged.
3. If more than one entry is defined with the supplied tag, an error message is printed to indicate that the *sequence-number* argument is required.

If the **no route-map** *map-tag* command is specified (with no *sequence-number* argument), the whole route map is deleted.

Examples

The following example redistributes Routing Information Protocol (RIP) routes with a hop count equal to 1 into Open Shortest Path First (OSPF). These routes will be redistributed into OSPF as external link-state advertisements (LSAs) with a metric of 5, metric type of Type 1, and a tag equal to 1.

```
Router(config)# router ospf 109
Router(config-router)# redistribute rip route-map rip-to-ospf
Router(config-router)# exit
Router(config)# route-map rip-to-ospf permit
Router(config-route-map)# match metric 1
Router(config-route-map)# set metric 5
Router(config-route-map)# set metric-type type1
Router(config-route-map)# set tag 1
```

The following example for IPv6 redistributes RIP routes with a hop count equal to 1 into OSPF. These routes will be redistributed into OSPF as external LSAs with a tag equal to 42 and a metric type equal to type1.

```
Router(config)# ipv6 router ospf 1
Router(config-router)# redistribute rip one route-map rip-to-ospfv3
Router(config-router)# exit
Router(config)# route-map rip-to-ospfv3
Router(config-route-map)# match tag 42
Router(config-route-map)# set metric-type type1
```

The following named configuration example redistributes Enhanced Interior Gateway Routing Protocol (EIGRP) addresses with a hop count equal to 1. These addresses are redistributed into EIGRP as external with a metric of 5 and a tag equal to 1:

```
Router(config)# router eigrp virtual-name1
Router(config-router)# address-family ipv4 autonomous-system 4453
Router(config-router-af)# topology base
Router(config-router-af-topology)# redistribute eigrp 6473 route-map
virtual-name1-to-virtual-name2
Router(config-router-af-topology)# exit-address-topology
Router(config-router-af)# exit-address-family
Router(config-router)# router eigrp virtual-name2
Router(config-router)# address-family ipv4 autonomous-system 6473
Router(config-router-af)# topology base
Router(config-router-af-topology)# exit-af-topology
Router(config-router-af)# exit-address-family
Router(config)# route-map virtual-name1-to-virtual-name2
Router(config-route-map)# match tag 42
Router(config-route-map)# set metric 5
Router(config-route-map)# set tag 1
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
ipv6 policy route-map	Configures IPv6 PBR on an interface.
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.

Command	Description
match ipv6 address	Distributes IPv6 routes that have a prefix permitted by a prefix list or to specify an IPv6 access list to use to match packets for PBR for IPv6.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match length	Bases policy routing on the Level 3 length of a packet.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
router eigrp	Configures the EIGRP address-family process.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of a route map for policy routing.
set ipv6 default next-hop	Specifies an IPv6 default next hop to which matching packets will be forwarded.
set ip default next-hop verify-availability	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.
set ipv6 next-hop (PBR)	Indicates where to output IPv6 packets that pass a match clause of a route map for PBR for IPv6.
set level (IP)	Indicates where to import routes.
set local preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

routing dynamic

To enable the router to pass routing updates to other routers through an interface, use the **routing dynamic** command in interface configuration mode. To disable the passing of routing updates through an interface, use the **no** form of this command.

routing dynamic

no routing dynamic

Syntax Description

This command has no arguments or keywords.

Command Default

Asynchronous interfaces: No routing updates are passed.
All other interface types: Routing updates are passed.

Command Modes

Interface configuration

Command History

Release	Modification
12.3(11)T	This command was introduced. This command replaces the **async default routing** command.

Usage Guidelines

Use the **routing dynamic** command to control the passing of routing updates over an interface.

Issuing the **no routing dynamic** command flags the interface to indicate that routing updates should not be sent out of it.

The routing protocol must recognize the flag for this command to work as intended. The **routing dynamic** command sets and clears the flag; it does not enforce routing protocol conformance.

Examples

The following example enables routing over asynchronous interface 0:

```
interface async 0
 routing dynamic
```

The following example disables routing over serial interface 2/0:

```
interface serial 2/0
 no routing dynamic
```

Related Commands

Command	Description
async dynamic routing	Enables manually configured routing on an asynchronous interface.
passive-interface	Disables sending routing updates on an interface.

send-lifetime

To set the time period during which an authentication key on a key chain is valid to be sent, use the **send-lifetime** command in key chain key configuration mode. To revert to the default value, use the **no** form of this command.

send-lifetime *start-time* {**infinite** | *end-time* | **duration** *seconds*}

no send-lifetime [*start-time* {**infinite** | *end-time* | **duration** *seconds*}]

Syntax Description

start-time	Beginning time that the key specified by the **key** command is valid to be sent. The syntax can be either of the following: *hh*:*mm*:*ss Month date year* *hh*:*mm*:*ss date Month year* *hh*—hours *mm*—minutes *ss*—seconds *Month*—first three letters of the month *date*—date (1–31) *year*—year (four digits) The default start time and the earliest acceptable date is January 1, 1993.
infinite	Key is valid to be sent from the *start-time* value on.
end-time	Key is valid to be sent from the *start-time* value until the *end-time* value. The syntax is the same as that for the *start-time* value. The *end-time* value must be after the *start-time* value. The default end time is an infinite time period.
duration *seconds*	Length of time (in seconds) that the key is valid to be sent.

Defaults

Forever (the starting time is January 1, 1993, and the ending time is infinite)

Command Modes

Key chain key configuration

Command History

Release	Modification
11.1	This command was introduced.
12.4(6)T	Support for IPv6 was added.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Specify a *start-time* value and one of the following values: **infinite**, *end-time*, or **duration** *seconds*.

We recommend running Network Time Protocol (NTP) or some other time synchronization method if you intend to set lifetimes on keys.

If the last key expires, authentication will continue and an error message will be generated. To disable authentication, you must manually delete the last valid key.

Examples

The following example configures a key chain called chain1. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or discrepancies in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
interface ethernet 0
 ip rip authentication key-chain chain1
 ip rip authentication mode md5
!
router rip
 network 172.19.0.0
 version 2
!
key chain chain1
 key 1
 key-string key1
 accept-lifetime 13:30:00 Jan 25 1996 duration 7200
 send-lifetime 14:00:00 Jan 25 1996 duration 3600
 key 2
 key-string key2
 accept-lifetime 14:30:00 Jan 25 1996 duration 7200
 send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

Command	Description
accept-lifetime	Sets the time period during which the authentication key on a key chain is received as valid.
key	Identifies an authentication key on a key chain.
key chain	Enables authentication for routing protocols.
key-string (authentication)	Specifies the authentication string for a key.
show key chain	Displays authentication key information.

set automatic-tag

To automatically compute the tag value, use the **set automatic-tag** command in route-map configuration mode. To disable this function, use the **no** form of this command.

set automatic-tag

no set automatic-tag

Syntax Description

This command has no arguments or keywords.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

You must have a match clause (even if it points to a "permit everything" list) if you want to set tags.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution *set actions* to be performed when all the match criteria of a route map are met. When all match criteria are met, all set actions are performed.

Examples

The following example configures the Cisco IOS software to automatically compute the tag value for the Border Gateway Protocol (BGP) learned routes:

```
route-map tag
 match as path 10
 set automatic-tag
!
router bgp 100
 table-map tag
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set tag (IP)	Sets a tag value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.
show route-map	Displays all route maps configured or only the one specified.

set default interface

To indicate where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination, use the **set default interface** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

set default interface *type number* [*...type number*]

no set default interface *type number* [*...type number*]

Syntax Description

type	Interface type, used with the interface number, to which packets are output.
number	Interface number, used with the interface type, to which packets are output.

Command Default

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
11.0	This command was introduced.
12.3(7)T	This command was updated for use in configuring IPv6 policy-based routing (PBR).
12.2(30)S	This command was integrated into Cisco IOS Release 12.2(30)S.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *type* and *number* arguments.

Use this command to provide certain users a different default route. If the Cisco IOS software has no explicit route for the destination, then it routes the packet to this interface. The first interface specified with the **set default interface** command that is up is used. The optionally specified interfaces are tried in turn.

Use the **ip policy route-map** interface configuration command, the **route-map** global configuration command, and the **match** and **set** route-map configuration commands to define the conditions for policy routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the match criteria—the conditions under which policy routing occurs. The **set** commands specify the set actions—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

In PBR for IPv6, use the **ipv6 policy route-map** or **ipv6 local policy route-map** command with match and set route map configuration commands to define conditions for policy routing packets.

The set clauses can be used in conjunction with one another. They are evaluated in the following order:

1. **set ip next-hop**
2. **set interface**
3. **set ip default next-hop**
4. **set default interface**

Examples

In the following example, packets that have a Level 3 length of 3 to 50 bytes and for which the software has no explicit route to the destination are output to Ethernet interface 0:

```
interface serial 0
 ip policy route-map brighton
!
route-map brighton
 match length 3 50
 set default interface ethernet 0
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
ipv6 local policy route-map	Identifies a route map to use for local IPv6 PBR.
ipv6 policy route-map	Configures IPv6 PBR on an interface.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ipv6 address	Specifies an IPv6 access list to use to match packets for PBR for IPv6.
match length	Bases policy routing on the Level 3 length of a packet.
route-map	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip default next-hop verify-availability	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ipv6 default next-hop	Specifies an IPv6 default next hop to which matching packets will be forwarded.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.
set ipv6 next-hop (PBR)	Indicates where to output IPv6 packets that pass a match clause of a route map for policy routing.
set ipv6 precedence	Sets the precedence value in the IPv6 packet header.

set interface

To indicate where to forward packets that pass a match clause of a route map for policy routing, use the **set interface** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

set interface *type number* [*...type number*]

no set interface *type number* [*...type number*]

Syntax Description

type	Interface type, used with the interface number, to which packets are forwarded.
number	Interface number, used with the interface type, to which packets are forwarded.

Command Default

Packets that pass a match clause are not forwarded to an interface.

Command Modes

Route-map configuration (config-route-map)

Command History

Release	Modification
11.0	This command was introduced.
12.3(7)T	This command was updated for use in configuring IPv6 policy-based routing (PBR).
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB, and hardware switching support was introduced for the Cisco 7600 series platform.
12.2SX	This command was integrated into the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *type* and *number* arguments.

Use the **ip policy route-map** interface configuration command, the **route-map** global configuration command, and the **match** and **set** route-map configuration commands to define the conditions for policy-routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing occurs. The **set** commands specify the *set actions*—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

In PBR for IPv6, use the **ipv6 policy route-map** or **ipv6 local policy route-map** command with **match** and **set** route-map configuration commands to define conditions for policy-routing packets.

If the first interface specified with the **set interface** command is down, the optionally specified interfaces are tried in turn.

The **set** clauses can be used in conjunction with one another. They are evaluated in the following order:

1. **set ip next-hop**
2. **set interface**
3. **set ip default next-hop**
4. **set default interface**

A useful next hop implies an interface. As soon as a next hop and an interface are found, the packet is routed.

Specifying the **set interface null 0** command is a way to write a policy that the packet be dropped and an "unreachable" message be generated. In Cisco IOS Release 12.4(15)T and later releases, the packets are dropped; however, the "unreachable" messages are generated only when CEF is disabled.

In Cisco IOS Release 12.2(33)SRB and later releases, hardware switching support was introduced for PBR packets sent over a traffic engineering (TE) tunnel interface on a Cisco 7600 series router. When a TE tunnel interface is configured using the **set interface** command in a policy, the packets are processed in hardware. In previous releases, PBR packets sent over TE tunnels are fast switched by Route Processor software.

Examples

In the following example, packets with a Level 3 length of 3 to 50 bytes are forwarded to Ethernet interface 0:

```
interface serial 0
 ip policy route-map testing
!
route-map testing
 match length 3 50
 set interface ethernet 0
```

In the following example for IPv6, packets with a Level 3 length of 3 to 50 bytes are forwarded to Ethernet interface 0:

```
interface serial 0
 ipv6 policy route-map testing
!
route-map testing
 match length 3 50
 set interface ethernet 0
```

In the following example, a TE tunnel interface is configured on a Cisco 7600 series router using the **set interface** command in a policy, and the packets are processed in hardware, instead of being fast switched by Route Processor software. This example can be used only with a Cisco IOS Release 12.2(33)SRB, or later release, image.

```
interface Tunnel101
 description FRR-Primary-Tunnel
 ip unnumbered Loopback0
 tunnel destination 172.17.2.2
 tunnel mode mpls traffic-eng
 tunnel mpls traffic-eng autoroute announce
 tunnel mpls traffic-eng path-option 1 explicit name p1
!
access-list 101 permit ip 10.100.0.0 0.255.255.255 any
!
route-map test permit 10
 match ip address 101
 set interface Tunnel101
!
```

```
interface GigabitEthernet9/5
 description TO_CE_C1A_FastEther-5/5
 ip address 192.168.5.1 255.255.255.0
 ip policy route-map test
 no keepalive
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
ipv6 local policy route-map	Configures PBR for IPv6 for originated packets.
ipv6 policy route-map	Configures IPv6 PBR on an interface.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ipv6 address	Specifies an IPv6 access list to use to match packets for PBR for IPv6.
match length	Bases policy routing on the Level 3 length of a packet.
route-map	Defines the conditions for redistributing routes from one routing protocol into another or enables policy routing.
set default interface	Indicates where to forward packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set ip default next-hop verify-availability	Indicates where to forward packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to forward packets that pass a match clause of a route map for policy routing.
set ipv6 default next-hop	Specifies an IPv6 default next hop to which matching packets will be forwarded.
set ipv6 next-hop (PBR)	Indicates where to output IPv6 packets that pass a match clause of a route map for policy routing.
set ipv6 precedence	Sets the precedence value in the IPv6 packet header.

set ip default next-hop

To indicate where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination, use the **set ip default next-hop** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

set ip default next-hop *ip-address* [*...ip-address*]

no set ip default next-hop *ip-address* [*...ip-address*]

Syntax Description

ip-address	IP address of the next hop to which packets are output.The next hop must be an adjacent router.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
11.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *ip-address* argument.

Use this command to provide certain users a different default route. If the software has no explicit route for the destination in the packet, then it routes the packet to this next hop. The first next hop specified with the **set ip default next-hop** command needs to be adjacent to the router. The optional specified IP addresses are tried in turn.

Use the **ip policy route-map** interface configuration command, the **route-map** global configuration command, and the **match** and **set** route-map configuration commands to define the conditions for policy routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing occurs. The **set** commands specify the *set actions*—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

The set clauses can be used in conjunction with one another. They are evaluated in the following order:

1. **set ip next-hop**
2. **set interface**

3. **set ip default next-hop**
4. **set default interface**

Note The **set ip next-hop** and **set ip default next-hop** are similar commands but have a different order of operations. Configuring the **set ip next-hop** command causes the system to use policy routing first and then use the routing table. Configuring the **set ip default next-hop** command causes the system to use the routing table first and then policy route the specified next hop.

Examples

The following example provides two sources with equal access to two different service providers. Packets arriving on asynchronous interface 1 from the source 10.1.1.1 are sent to the router at 172.16.6.6 if the software has no explicit route for the destination of the packet. Packets arriving from the source 10.2.2.2 are sent to the router at 172.17.7.7 if the software has no explicit route for the destination of the packet. All other packets for which the software has no explicit route to the destination are discarded.

```
access-list 1 permit ip 10.1.1.1 0.0.0.0
access-list 2 permit ip 10.2.2.2 0.0.0.0
!
interface async 1
 ip policy route-map equal-access
!
route-map equal-access permit 10
 match ip address 1
 set ip default next-hop 172.16.6.6
route-map equal-access permit 20
 match ip address 2
 set ip default next-hop 172.17.7.7
 route-map equal-access permit 30
 set default interface null0
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.

set ip default next-hop verify-availability

To configure a router, for policy routing, to check the CDP database for the availability of an entry for the default next hop that is specified by the **set ip default next-hop** command, use the **set ip default next-hop verify-availability** route map configuration command. To disable this function, use the **no** form of this command.

set ip default next-hop verify-availability

no set ip default next-hop verify-availability

Syntax Description

This command has no arguments or keywords.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
12.1(1.05)T	This command was introduced.

Usage Guidelines

Use this command to force the configured policy routing to check the CDP database to determine if an entry is available for the next hop that is specified by the **set ip default next-hop** command. This command is used to prevent traffic from being "black holed" if the configured next hop becomes unavailable.

Examples

The following example:

```
Router(config-route-map)# set ip default next-hop verify-availability
```

Related Commands

Command	Description
set ip default next-hop verify-availability	Configures policy routing to verify if the next hops of a route map are CDP neighbors before policy routing to those next hops.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.

set ip global

To indicate where to forward packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software uses the global routing table, use the **set ip global** command in route-map configuration mode. To disable this feature, use the **no** form of this command.

set ip global next-hop *ip-address* [*...ip-address*]

no set ip global next-hop *ip-address* [*...ip-address*]

Syntax Description

next-hop *ip-address*	IP address of the next hop.

Command Default

The router uses the next-hop address in the global routing table.

Command Modes

Route-map configuration

Command History

Release	Modification
12.2(33)SRB1	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.

Usage Guidelines

Use this command to allow packets to enter a VRF interface and be policy-routed or forwarded out of the global table.

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *ip-address* argument.

Examples

The following example allows use of the global table and specifies that the next-hop address is 10.5.5.5:

```
set ip global next-hop 10.5.5.5
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.

Command	Description
set interface	Indicates where to output packets that pass a match clause of a route map for policy routing.
set ip default next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip vrf	Indicates where to forward packets that pass a match clause of a route map for policy routing when the next hop must be under a specified VRF name.

set ip next-hop

To indicate where to output packets that pass a match clause of a route map for policy routing, use the **set ip next-hop** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

set ip next-hop {*ip-address* [*...ip-address*] | **recursive** *ip-address*}

no set ip next-hop *ip-address* [*...ip-address*]

Syntax Description

ip-address	IP address of the next hop to which packets are output. It must be the address of an adjacent router.
recursive *ip-address*	IP address of the recursive next-hop router. **Note** The next-hop IP address must be assigned separately from the recursive next-hop IP address.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
11.0	This command was introduced.
12.0(28)S	The **recursive** keyword was added.
12.3(14)T	This command was integrated into Cisco IOS Release 12.3(14)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *ip-address* argument.

Use the **ip policy route-map** interface configuration command, the **route-map** global configuration command, and the **match** and **set** route-map configuration commands to define the conditions for policy routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which policy routing occurs. The **set** commands specify the *set actions*—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

If the interface associated with the first next hop specified with the **set ip next-hop** command is down, the optionally specified IP addresses are tried in turn.

The set clauses can be used in conjunction with one another. They are evaluated in the following order:

1. **set ip next-hop**
2. **set interface**
3. **set ip default next-hop**
4. **set default interface**

Note The **set ip next-hop** and **set ip default next-hop** are similar commands but have a different order of operations. Configuring the **set ip next-hop** command causes the system to use policy routing first and then use the routing table. Configuring the **set ip default next-hop** command causes the system to use the routing table first and then policy route the specified next hop.

Examples

In the following example, packets with a Level 3 length of 3 to 50 bytes are output to the router at IP address 10.14.2.2:

```
interface serial 0
 ip policy route-map thataway
!
route-map thataway
 match length 3 50
 set ip next-hop 10.14.2.2
```

In the following example, the IP address of 10.3.3.3 is set as the recursive next-hop address:

```
route-map map_recurse
 set ip next-hop recursive 10.3.3.3
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip default next-hop verify-availability	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.

set ip next-hop verify-availability

To configure policy routing to verify the reachability of the next hop of a route map before the router performs policy routing to that next hop, use the **set ip next-hop verify-availability** command in route-map configuration mode. To disable this function, use the **no** form of this command.

set ip next-hop verify-availability [*next-hop-address sequence* **track** *object*]

no set ip next-hop verify-availability [*next-hop-address sequence* **track** *object*]

Syntax Description

next-hop-address	(Optional) IP address of the next hop to which packets will be forwarded.
sequence	(Optional) Sequence of next hops. The acceptable range is from 1 to 65535.
track	(Optional) The tracking method is track.
object	(Optional) Object number that the tracking subsystem is tracking. The acceptable range is from 1 to 500.

Command Default

The reachability of the next hop of a route map before a router performs policy routing, is not verified.

Command Modes

Route-map configuration (config-route-map)

Command History

Release	Modification
12.0(3)T	This command was introduced.
12.3(4)T	The optional **track** keyword and *next-hop-address*, *sequence*, and *object* arguments were added.
12.3(14)T	The SAA feature (uses **rtr** commands) was replaced by the IP SLAs feature (uses **ip sla** commands).
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

The **set ip next-hop verify-availability** command can be used in the following two ways:

- With policy-based routing (PBR) to verify next hop reachability using Cisco Discovery Protocol (CDP).
- With optional arguments to support object tracking using Internet Control Message Protocol (ICMP) ping or an HTTP GET request to verify if a remote device is reachable.

Using CDP Verification

This command is used to verify that the next hop is reachable before the router tries to policy route to it. This command has the following characteristics:

- It causes some performance degradation.
- CDP must be configured on the interface.
- The next hop must be a Cisco device with CDP enabled.
- It is supported in process switching and Cisco Express Forwarding (CEF) policy routing, but is not available in distributed CEF (dCEF) because of the dependency of the CDP neighbor database.

If the router is policy routing packets to the next hop and the next hop is down, the router will try unsuccessfully to use Address Resolution Protocol (ARP) for the next hop (which is down). This behavior will continue indefinitely. To prevent this situation from occurring, use the **set ip next-hop verify-availability** command to configure the router to verify that the next hop of the route map is a CDP neighbor before routing to that next hop.

This command is optional because some media or encapsulations do not support CDP, or it may not be a Cisco device that is sending traffic to the router.

If this command is set and the next hop is not a CDP neighbor, then the router looks to the subsequent next hop, if there is one. If there is no next hop, the packets are not policy routed.

If this command is not set, the packets are either successfully policy routed or remain forever unrouted.

If you want to selectively verify availability of only some next hops, you can configure different route map entries (under the same route map name) with different criteria (using access list matching or packet size matching), and then use the **set ip next-hop verify-availability** command selectively.

Using Object Tracking

With optional arguments to support object tracking, this command allows PBR to make decisions based on the following criteria:

- ICMP ping reachability to a remote device.
- Application running on a remote device (for example, the device responds to an HTTP GET request).
- A route exists in the Routing Information Base (RIB) (for example, policy route only if 10.2.2.0/24 is in the RIB).
- Interface state (for example, packets received on E0 should be policy routed out E1 only if E2 is down).

Object tracking functions in the following manner. PBR will inform the tracking process that it is interested in tracking a certain object. The tracking process will in turn notify PBR when the state of the object changes. This notification is done via registries and is event driven.

The tracking subsystem is responsible for tracking the state of an object. The object can be an IP address that is periodically being pinged by the tracking process. The state of the object (up or down) is stored in a track report data structure. The tracking process will create the tracking object report. Then the exec process that is configuring the route map can query the tracking process to determine if a given object exists. If the object exists, the tracking subsystem can start tracking it and read the initial state of the object. If the object changes state, the tracking process will notify all the clients that are tracking this process that the state of the object has changed. So, the route map structure that PBR is using can be updated to reflect the current state of the object in the track report. This interprocess communication is done by means of registries and the shared track report.

Note If the CDP and object tracking commands are mixed, the tracked next hops will be tried first.

Examples

The following configuration sample demonstrates the use of the **set ip next-hop verify-availability** command to configure the router to verify that the next hop of the route map is a CDP neighbor before routing to that next hop. In this example, the next hop 10.0.0.8 in the route map named "Example1" will be verified as a CDP neighbor before the router tries to policy-route to it.

```
ip cef
interface ethernet0/0/1
 ip policy route-map Example1
route-map Example1 permit 10
 match ip address 1
 set ip precedence priority
 set ip next-hop 10.0.0.8
 set ip next-hop verify-availability
route-map Example1 permit 20
 match ip address 101
 set interface Ethernet0/0/3
 set ip tos max-throughput
```

Using Object Tracking

The following configuration sample shows a configuration used to track an object:

```
! Configure the objects to be tracked.
! Object 123 will be up if the router can ping 10.1.1.1.
! Object 124 will be up if the router can ping 10.2.2.2.
ip sla monitor 1
 type echo protocol ipicmpecho 10.1.1.1
ip sla monitor schedule 1 start-time now life forever
!
ip sla monitor 2
 type echo protocol ipicmpecho 10.2.2.2
ip sla monitor schedule 2 start-time now life forever
!
track 123 rtr 1 reachability
track 124 rtr 2 reachability
!
! Enable policy routing using route-map alpha on Ethernet 0.
interface ethernet 0
 ip address 10.4.4.254 255.255.255.0
 ip policy route-map alpha
!
! 10.1.1.1 is via this interface
interface ethernet 1
 ip address 10.1.1.254 255.255.255.0

! 10.2.2.2 is via this interface
interface ethernet 2
 ip address 10.2.2.254 255.255.255.0
!
! Configure a route-map to set the next-hop to 10.1.1.1 if object 123 is up. If object 123
! is down, the next hop will be set to 10.2.2.2 if object 124 is up. If object 124 is also
! down, then policy routing fails and unicast routing will route the packet.
route-map alpha
 set ip next-hop verify-availability 10.1.1.1 10 track 123
 set ip next-hop verify-availability 10.2.2.2 20 track 124
```

Related Commands

Command	Description
show route-map	Displays the configured route maps.
show track	Displays information about objects that are tracked by the tracking process.
track	Tracks the state of an interface, an ip route, or a response time reporter.

set ip vrf

To indicate where to forward packets that pass a match clause of a route map for policy routing when the next hop must be under a specified virtual routing and forwarding (VRF) name, use the **set ip vrf** command in route-map configuration mode. To disable this feature, use the **no** form of this command.

set ip vrf *vrf-name* **next-hop** {*ip-address* [*... ip-address*] | **recursive** *ip-address*}

no set ip vrf *vrf-name* **next-hop** {*ip-address* [*... ip-address*] | **recursive** *ip-address*}

Syntax Description

vrf-name	Name of the VRF.
next-hop *ip-address*	IP address of the next hop to which packets are forwarded. The next hop must be an adjacent router.
next-hop recursive *ip-address*	IP address of the recursive next-hop router. **Note** The next-hop IP address must be assigned separately from the recursive next-hop IP address.

Command Default

Policy-based routing is not applied to a VRF interface.

Command Modes

Route-map configuration

Command History

Release	Modification
12.2(33)SRB1	This command was introduced.
12.4(24)T	This command was integrated into Cisco IOS Release 12.4(24)T.

Usage Guidelines

The **set ip vrf** command allows you to apply policy-based routing to a VRF interface.

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *ip-address* argument.

Use the **ip policy route-map** interface configuration command, the **route-map** global configuration command, and **match** configuration commands to define the conditions for policy-routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the match criteria—the conditions under which policy routing occurs. The **set** commands specify the set actions—the particular routing actions to perform if the criteria enforced by the **match** commands are met.

If the interface associated with the first next hop specified with the **set ip vrf** command is down, the optionally specified IP addresses are tried in turn.

The set clauses can be used in conjunction with one another. They are evaluated in the following order:

1. set TOS
2. set DF (Don’t Fragment) bit in IP header
3. set vrf

4. set ip next-hop
5. set interface
6. set ip default next-hop
7. set default interface

Examples

The following example specifies that the next hop must be under the VRF name that has the IP address 10.5.5.5:

```
set ip vrf myvrf next-hop 10.5.5.5
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of a route map for policy routing.
set ip default next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisc IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.

set level (IP)

To indicate where to import routes, use the **set level** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

set level {**level-1** | **level-2** | **level-1-2** | **nssa-only** | **stub-area** | **backbone**}

no set level {**level-1** | **level-2** | **level-1-2** | **nssa-only** | **stub-area** | **backbone**}

Syntax Description

level-1	Imports routes into a Level 1 area.
level-2	Imports routes into a Level 2 subdomain.
level-1-2	Imports routes into Level 1 and Level 2 areas.
nssa-only	Imports routes only into NSSA areas.
stub-area	Imports routes into an Open Shortest Path First (OSPF) NSSA area.
backbone	Imports routes into an OSPF backbone area.

Defaults

This command is disabled by default.
For Intermediate System-to-Intermediate System (IS-IS) destinations, the default value is **level-2**.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
15.0(1)M	This command was modified. The **nssa-only** keyword was added.
12.2(33)SRE	This command was modified. The **nssa-only** keyword was added.

Usage Guidelines

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution *set actions* to be performed when all the match criteria of a route map are met. When all match criteria are met, all set actions are performed.

The **stub-area** and **backbone** keywords have no effect on where routes are imported.

Examples

In the following example, routes will be imported into the Level 1 area:

```
route-map name
 set level level-1
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set ip next-hop	Specifies the address of the next hop.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set origin (BGP)	Sets the BGP origin code.
set tag (IP)	Sets the value of the destination routing protocol.

set local-preference

To specify a preference value for the autonomous system path, use the **set local-preference** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

set local-preference *number-value*

no set local-preference *number-value*

Syntax Description

number-value	Preference value. An integer from 0 to 4294967295.

Defaults

Preference value of 100

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

The preference is sent only to all routers in the local autonomous system.

You must have a match clause (even if it points to a "permit everything" list) if you want to set tags.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution *set actions* to be performed when all the match criteria of a route map are met. When all match criteria are met, all set actions are performed.

You can change the default preference value with the **bgp default local-preference** command.

Examples

The following example sets the local preference to 100 for all routes that are included in access list 1:

```
route-map map-preference
 match as-path 1
 set local-preference 100
```

Related Commands

Command	Description
bgp default local-preference	Changes the default local preference value.
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set ip next-hop	Specifies the address of the next hop.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set origin (BGP)	Sets the BGP origin code.
set tag (IP)	Sets the value of the destination routing protocol.

set metric (BGP-OSPF-RIP)

To set the metric value for a routing protocol, use the **set metric** command in route-map configuration mode. To return to the default metric value, use the **no** form of this command.

set metric *metric-value*

no set metric *metric-value*

Syntax Description

metric-value	Metric value; an integer from –294967295 to 294967295. This argument applies to all routing protocols except Enhanced Interior Gateway Routing Protocol (EIGRP).

Defaults

The dynamically learned metric value.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

We recommend that you consult your Cisco technical support representative before changing the default value.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution *set actions* to be performed when all the match criteria of a route map are met. When all match criteria are met, all set actions are performed.

Examples

The following example sets the metric value for the routing protocol to 100:

```
route-map set-metric
 set metric 100
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set ip next-hop	Specifies the address of the next hop.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set origin (BGP)	Sets the BGP origin code.
set tag (IP)	Sets the value of the destination routing protocol.

set metric-type

To set the metric type for the destination routing protocol, use the **set metric-type** command in route-map configuration mode. To return to the default, use the **no** form of this command.

set metric-type {**internal | external | type-1 | type-2**}

no set metric-type {**internal | external | type-1 | type-2**}

Syntax Description

internal	Intermediate System-to-Intermediate System (IS-IS) internal metric, or IGP metric as the MED for BGP.
external	IS-IS external metric.
type-1	Open Shortest Path First (OSPF) external Type 1 metric.
type-2	OSPF external Type 2 metric.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Use the **route-map** global configuration command with **match** and **set** route-map configuration commands to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution *set actions* to be performed when all the match criteria of a route map are met. When all match criteria are met, all set actions are performed.

Note This command is not supported for redistributing routes into Border Gateway Protocol (BGP).

Examples

The following example sets the metric type of the destination protocol to OSPF external Type 1:

```
route-map map-type
 set metric-type type-1
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set ip next-hop	Specifies the address of the next hop.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set origin (BGP)	Sets the BGP origin code.
set tag (IP)	Sets the value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

set next-hop

To specify the address of the next hop, use the **set next-hop** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

set next-hop *next-hop*

no set next-hop *next-hop*

Syntax Description

next-hop	IP address of the next hop router.

Defaults

Default next hop address.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

You must have a match clause (even if it points to a "permit everything" list) if you want to set tags.

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution *set actions* to be performed when all the match criteria of the router are met. When all match criteria are met, all set actions are performed.

Examples

In the following example, routes that pass the access list have the next hop set to 172.160.70.24:

```
route-map map_hop
 match address 5
 set next-hop 172.160.70.24
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set ip next-hop	Specifies the address of the next hop.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set origin (BGP)	Sets the BGP origin code.
set tag (IP)	Sets the value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

set tag (IP)

To set a tag value of the destination routing protocol, use the **set tag** command in route-map configuration mode. To delete the entry, use the **no** form of this command.

set tag *tag-value*

no set tag *tag-value*

Syntax Description

tag-value	Name for the tag. Integer from 0 to 4294967295.

Command Default

If not specified, the default action is to *forward* the tag in the source routing protocol onto the new destination protocol.

Command Modes

Route-map configuration (config-route-map)

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 Series Aggregation Services Routers.

Usage Guidelines

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*—the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution *set actions* to be performed when all the match criteria of a route map are met. When all match criteria are met, all set actions are performed.

Examples

The following example sets the tag value of the destination routing protocol to 5:

```
Router(config)# route-map tag
Router(config-router)#  set tag 5
```

Related Commands

Command	Description
match as-path	Matches a BGP autonomous system path access list.
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
route-map	Defines the conditions for redistributing routes from one routing protocol into another.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set automatic-tag	Automatically computes the tag value.
set community	Sets the BGP communities attribute.
set ip next-hop	Specifies the address of the next hop.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set origin (BGP)	Sets the BGP origin code.
set tag (IP)	Sets the value of the destination routing protocol.

show bfd neighbors

To display a line-by-line listing of existing Bidirectional Forwarding Detection (BFD) adjacencies, use the **show bfd neighbors** command in user EXEC or privileged EXEC mode.

show bfd neighbors [**client** {**bgp** | **eigrp** | **isis** | **ospf** | **rsvp** | **te-frr**} | **details** | [*interface-type interface-number*] | **internal** | **ipv4** *ip-address* | **ipv6** *ipv6-address* | **vrf** *vrf-name*]

Syntax Description

client	(Optional) Displays neighbors of a specific client.
bgp	(Optional) Specifies a Border Gateway Protocol (BGP) client.
eigrp	(Optional) Specifies an Enhanced Interior Gateway Routing Protocol (EIGRP) client.
isis	(Optional) Specifies an Intermediate System-to-Intermediate System (IS-IS) client.
ospf	(Optional) Specifies an Open Shortest Path First (OSPF) client.
rsvp	(Optional) Specifies an Resource Reservation Protocol (RSVP) client.
te-frr	(Optional) Specifies a Traffic Engineering (TE) Fast Reroute (FRR) client.
details	(Optional) Displays all BFD protocol parameters and timers for each neighbor.
interface-type interface-number	(Optional) Displays neighbors at a specified interface.
internal	(Optional) Displays internal BFD information
ipv4	(Optional) Specifies an IPv4 neighbor. If the **ipv4** keyword is used without the *ip-address* argument, all IPv4 sessions are displayed.
ip-address	(Optional) IP address of a neighbor, in A.B.C.D format.
ipv6	(Optional) Specifies an IPv6 neighbor. If the **ipv6** keyword is used without the *ipv6-address* argument, all IPv6 sessions are displayed.
ipv6-address	(Optional) IPv6 address of a neighbor, in X:X:X:X::X format.
vrf *vrf-name*	(Optional) Displays entries for a specific Virtual Private Network (VPN) routing and forwarding (VRF) instance.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

OS Release	Modification
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
S Release	**Modification**
12.2(18)SXE	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRC	The **vrf** *vrf-name* keyword and argument, the **client** keyword, and the *ip-address* argument were added in this release.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.

12.2(33)SXI	The command was modified. The output was modified to display the "OurAddr" field only with the **details** keyword.
12.2(33)SRE	This command was modified. Support for IPv6 was added.
T Release	**Modification**
12.4(4)T	This command was integrated into Cisco IOS Release 12.4(4)T.
12.4(9)T	Support for BFD Version 1 and BFD echo mode was added.
X Release	**Modification**
Cisco IOS XE Release 2.1	Support for IPv6 was added.

Usage Guidelines

The **show bfd neighbors** command can be used to help troubleshoot the BFD feature.

The full output for the **details** keyword is not supported on the Route Processor (RP) for the Cisco 12000 series Internet router. If you want to enter the **show bfd neighbors** command with the **details** keyword on the Cisco 12000 series Internet router, you must enter it on the line card. Use the **attach** *slot* command to establish a command-line interface (CLI) session with a line card.

Examples

Examples for 12.0(31)S, 12.2(18)SXE, 12.2(33)SRA, 12.2(33)SB, and 12.4(4)T

The following sample output shows the status of the adjacency or neighbor:

```
Router# show bfd neighbors

OurAddr       NeighAddr      LD/RD RH  Holdown(mult) State     Int
172.16.10.1   172.16.10.2    1/6  1   260  (3 )      Up        Fa0/1
```

The following sample output from the **show bfd neighbors** command entered with the **details** keyword shows BFD protocol parameters and timers for each neighbor:

```
Router# show bfd neighbors details

NeighAddr                          LD/RD    RH/RS     State     Int
10.1.1.2                            1/1         1(RH) Up        Et0/0
Session state is UP and not using echo function.
OurAddr: 10.1.1.1
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3 Received MinRxInt: 50000, Received
Multiplier: 3 Holddown (hits): 150(0), Hello (hits): 50(2223) Rx Count: 2212, Rx Interval
(ms) min/max/avg: 8/68/49 last: 0 ms ago Tx Count: 2222, Tx Interval (ms) min/max/avg:
40/60/49 last: 20 ms ago Elapsed time watermarks: 0 0 (last: 0) Registered protocols: CEF
Stub
Uptime: 00:01:49
Last packet: Version: 0                  - Diagnostic: 0
             I Hear You bit: 1           - Demand bit: 0
             Poll bit: 0                 - Final bit: 0
             Multiplier: 3               - Length: 24
             My Discr.: 1                - Your Discr.: 1
             Min tx interval: 50000      - Min rx interval: 50000
             Min Echo interval: 50000
```

The following sample output from the RP on a Cisco 12000 series router shows the status of the adjacency or neighbor:

```
Router# show bfd neighbors

Cleanup timer hits: 0
```

```
OurAddr       NeighAddr     LD/RD RH  Holdown(mult)  State     Int
172.16.10.2   172.16.10.1    2/0  0   0    (0 )      Up        Fa6/0
 Total Adjs Found: 1
```

The following sample output from the RP on a Cisco 12000 series router shows the status of the adjacency or neighbor with the **details** keyword:

```
RouterB# show bfd neighbors details

Cleanup timer hits: 0

OurAddr       NeighAddr     LD/RD RH  Holdown(mult)  State     Int
172.16.10.2   172.16.10.1    2/0  0   0    (0 )      Up        Fa6/0
Registered protocols: OSPF
Uptime: never
%% BFD Neighbor statistics are not available on RP. Please execute this command on Line
Card.
```

The following sample output from a line card on a Cisco 12000 series router shows the status of the adjacency or neighbor:

```
Router# attach 6

Entering Console for 8 Port Fast Ethernet in Slot: 6
Type "exit" to end this session

Press RETURN to get started!

Router> show bfd neighbors

Cleanup timer hits: 0

OurAddr       NeighAddr     LD/RD RH  Holdown(mult)  State     Int
172.16.10.2   172.16.10.1    2/1  1   848  (5 )      Up        Fa6/0
 Total Adjs Found: 1
```

The following sample output from a line card on a Cisco 12000 series router shows the status of the adjacency or neighbor with the **details** keyword:

```
Router# attach 6

Entering Console for 8 Port Fast Ethernet in Slot: 6
Type "exit" to end this session

Press RETURN to get started!

Router> show bfd neighbors details

Cleanup timer hits: 0

OurAddr       NeighAddr     LD/RD RH  Holdown(mult)  State     Int
172.16.10.2   172.16.10.1    2/1  1   892  (5 )      Up        Fa6/0
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 50000, MinRxInt: 1000, Multiplier: 3
Received MinRxInt: 200000, Received Multiplier: 5
Holdown (hits): 1000(0), Hello (hits): 200(193745)
Rx Count: 327406, Rx Interval (ms) min/max/avg: 152/248/196 last: 108 ms ago
Tx Count: 193748, Tx Interval (ms) min/max/avg: 204/440/331 last: 408 ms ago
Last packet: Version: 0            - Diagnostic: 0
             I Hear You bit: 1     - Demand bit: 0
             Poll bit: 0           - Final bit: 0
             Multiplier: 5         - Length: 24
             My Discr.: 1          - Your Discr.: 2
```

```
            Min tx interval: 200000    - Min rx interval: 200000
            Min Echo interval: 0
Uptime: 17:54:07
SSO Cleanup Timer called: 0
SSO Cleanup Action Taken: 0
Pseudo pre-emptive process count: 7728507 min/max/avg: 8/16/8 last: 12 ms ago
 IPC Tx Failure Count: 0
 IPC Rx Failure Count: 0
 Total Adjs Found: 1
LC-Slot6>
```

Example for 12.4(9)T and Later Releases

The following sample output verifies that the BFD neighbor router is also running BFD Version 1 and that the BFD session is up and running in echo mode:

```
Router# show bfd neighbors details

OurAddr       NeighAddr     LD/RD  RH/RS   Holdown(mult)  State     Int
172.16.1.2    172.16.1.1     1/6    Up        0    (3 )   Up        Fa0/1
Session state is UP and using echo function with 50 ms interval.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 3
Received MinRxInt: 1000000, Received Multiplier: 3
Holdown (hits): 3000(0), Hello (hits): 1000(337)
Rx Count: 341, Rx Interval (ms) min/max/avg: 1/1008/882 last: 364 ms ago
Tx Count: 339, Tx Interval (ms) min/max/avg: 1/1016/886 last: 632 ms ago
Registered protocols: EIGRP
Uptime: 00:05:00
Last packet: Version: 1            - Diagnostic: 0
             State bit: Up         - Demand bit: 0
             Poll bit: 0           - Final bit: 0
             Multiplier: 3         - Length: 24
             My Discr.: 6          - Your Discr.: 1
             Min tx interval: 1000000    - Min rx interval: 1000000
             Min Echo interval: 50000
```

Example for Cisco IOS XE Release 2.1 and Later Releases

The following example displays all IPv6 sessions:

```
Router# show bfd neighbors ipv6 2001::1

OurAddr    NeighAddr  LD/RD  RH/RS  Holddown(mult)  State  Int
1:1::5     1:1::6      2/2    Up        0    (3 )   Up     Et0/0
2:2::5     2:2::6      4/4    Up        0    (3 )   Up     Et1/0
```

Examples for Cisco IOS Release 12.2(33)SXI, 12.2(33)SRE, 12.2(33)XNA and Later Releases:

The following is sample output from the **show bfd neighbors** command:

```
Router# show bfd neighbors

NeighAddr                          LD/RD    RH/RS     State     Int
192.0.2.1                           4/0     Down      Down      Et0/0
192.0.2.2                           5/0     Down      Down      Et0/0
192.0.2.3                           6/0     Down      Down      Et0/0
192.0.2.4                           7/0     Down      Down      Et0/0
192.0.2.5                           8/0     Down      Down      Et0/0
192.0.2.6                          11/0         0(RH) Fail      Et0/0
1000:1:1:1:1:1:1:2                  9/0     Down      Down      Et0/0
1000:1:1:1:1:1:1:810               10/0     Down      Down      Et0/0
1000:1111:1111:111:11:111:11:5      1/0         0(RH) Fail      Et0/0
1000:1111:1111:111:11:111:11:6      2/0     Down      Down      Et0/0
```

```
1000:1111:1111:1111:1111:1111:1111:8810
                                    3/0     Down      Down      Et0/0
```

The following is sample output from the **show bfd neighbors details** command:

```
Router# show bfd neighbors details

NeighAddr                          LD/RD    RH/RS     State     Int
192.0.2.5                           4/0     Down      Down      Et0/0
OurAddr: 192.0.2.8
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 3
Received MinRxInt: 0, Received Multiplier: 0
Holddown (hits): 0(0), Hello (hits): 1000(120)
Rx Count: 0, Rx Interval (ms) min/max/avg: 0/0/0 last: 118672 ms ago
Tx Count: 120, Tx Interval (ms) min/max/avg: 760/1000/885 last: 904 ms ago
Elapsed time watermarks: 0 0 (last: 0)
Registered protocols: Stub
Last packet: Version: 1             - Diagnostic: 0
             State bit: AdminDown   - Demand bit: 0
             Poll bit: 0            - Final bit: 0
             Multiplier: 0          - Length: 0
             My Discr.: 0           - Your Discr.: 0
             Min tx interval: 0     - Min rx interval: 0
             Min Echo interval: 0


NeighAddr                          LD/RD    RH/RS     State     Int
1000:1:1:1:1:1:1:2                  9/0     Down      Down      Et0/0
OurAddr: 1000:1:1:1:1:1:1:1
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 3
Received MinRxInt: 0, Received Multiplier: 0
Holddown (hits): 0(0), Hello (hits): 1000(208)
Rx Count: 0, Rx Interval (ms) min/max/avg: 0/0/0 last: 194760 ms ago
Tx Count: 208, Tx Interval (ms) min/max/avg: 760/1000/878 last: 424 ms ago
Elapsed time watermarks: 0 0 (last: 0)
Registered protocols: Stub
Last packet: Version: 1             - Diagnostic: 0
             State bit: AdminDown   - Demand bit: 0
             Poll bit: 0            - Final bit: 0
             Multiplier: 0          - Length: 0
             My Discr.: 0           - Your Discr.: 0
             Min tx interval: 0     - Min rx interval: 0
             Min Echo interval: 0
```

Table 2 describes the significant fields shown in the display.

Table 2 show bfd neighbors Field Descriptions

Field	Description
OurAddr	IP address of the interface for which the **show bfd neighbors details** command was entered.
NeighAddr	IPv4 or IPv6 address of the BFD adjacency or neighbor.
LD/RD	Local discriminator and remote discriminator being used for the session.
RH	Remote Heard—Indicates that the remote BFD neighbor has been heard.
Holdown(mult)	The detect timer multiplier that is used for this session.

Table 2 show bfd neighbors Field Descriptions (continued)

Field	Description
State	State of the interface—Up or Down.
Int	Interface type and slot/port.
Session state is UP and using echo function with 50 ms interval.	BFD is up and running in echo mode. The 50-millisecond interval has been adopted from the **bfd** command. **Note** BFD Version 1 and echo mode are supported only with Cisco IOS Release 12.4(9)T and later releases.
RX Count	Number of BFD control packets that have been received from the BFD neighbor.
TX Count	Number of BFD control packets that have been sent by the BFD neighbor.
TX Interval	The interval, in milliseconds, between sent BFD packets.
Registered protocols	Routing protocols that have been registered with BFD.
Last packet: Version:	BFD version detected and run between the BFD neighbors. The system automatically performs BFD version detection, and BFD sessions between neighbors will run in the highest common BFD version between neighbors. For example, if one BFD neighbor is running BFD Version 0, and the other BFD neighbor is running Version 1, the session will run BFD Version 0. **Note** BFD Version 1 and echo mode are supported only with Cisco IOS Release 12.4(9)T and later releases.
Diagnostic	A diagnostic code specifying the local system's reason for the last transition of the session from Up to some other state. State values are as follows: • 0—No Diagnostic • 1—Control Detection Time Expired • 2—Echo Function Failed • 3—Neighbor Signaled Session Down • 4—Forwarding Plane Reset • 5—Path Down • 6—Concentrated Path Down • 7—Administratively Down
I Hear You bit	I Hear You Bit. This bit is set to 0 if the transmitting system either is not receiving BFD packets from the remote system or is tearing down the BFD session for some reason. During normal operation the I Hear You bit is set to 1 to signify that the remote system is receiving the BFD packets from the transmitting system.
Demand bit	Demand Mode bit. If set, the transmitting system wants to operate in demand mode. BFD has two modes—asynchronous and demand. The Cisco implementation of BFD supports only asynchronous mode.

Table 2 show bfd neighbors Field Descriptions (continued)

Field	Description
Poll bit	Poll bit. If the Poll bit is set, the transmitting system is requesting verification of connectivity or of a parameter change.
Final bit	Final bit. If the Final bit is set, the transmitting system is responding to a received BFD control packet that had a Poll (P) bit set.
Multiplier	Detect time multiplier. The negotiated transmit interval, multiplied by the detect time multiplier, determines the detection time for the transmitting system in BFD asynchronous mode. The detect time multiplier is similar to the hello multiplier in Intermediate System-to-Intermediate System (IS-IS), which is used to determine the hold timer: (hello interval) * (hello multiplier) = hold timer. If a hello packet is not received within the hold-timer interval, a failure has occurred. Similarly, for BFD: (transmit interval) * (detect multiplier) = detect timer. If a BFD control packet is not received from the remote system within the detect-timer interval, a failure has occurred.
Length	Length of the BFD control packet, in bytes.
My Discr.	My Discriminator. Unique, nonzero discriminator value generated by the transmitting system used to demultiplex multiple BFD sessions between the same pair of systems.
Your Discr.	Your Discriminator. The discriminator received from the corresponding remote system. This field reflects the received value of My Discriminator, or is zero if that value is unknown.
Min tx interval	Minimum transmission interval, in microseconds, that the local system wants to use when sending BFD control packets.
Min rx interval	Minimum receipt interval, in microseconds, between received BFD control packets that the system can support.
Min Echo interval	Minimum interval, in microseconds, between received BFD control packets that the system can support. If the value is zero, the transmitting system does not support the receipt of BFD echo packets. The Cisco implementation of BFD for Cisco IOS Releases 12.2(18)SXE and 12.0(31)S does not support the use of echo packets.

Related Commands

Command	Description
attach	Connects to a specific line card for the purpose of executing monitoring and maintenance commands on that line card only.

show dampening interface

To display a summary of dampened interfaces, use the **show damping interface** command in user EXEC or privileged EXEC mode.

show dampening interface

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
12.0(22)S	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
12.2(18)SXD	This command was integrated into Cisco IOS Release 12.2(18)SXD.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Examples

The following is sample output from the **show damping interface** command in privileged EXEC mode:

```
Router# show dampening interface

3 interfaces are configured with dampening.
No interface is being suppressed.
Features that are using interface dampening:
  IP Routing
  CLNS Routing
```

Table 3 describes the significant fields shown in the sample output of the **show dampening interface** command.

Table 3 show dampening interface Field Descriptions

Field	Description
... interfaces are configured with dampening.	Displays the number of interfaces that are configured for event dampening.
No interface is being suppressed.	Displays the suppression status of the interfaces that are configured for event dampening.
Features that are using interface dampening:	Displays the routing protocols that are configured to perceived interface dampening.

Related Commands

Command	Description
clear counters	Clears the interface counters.
dampening	Enables IP event dampening at the interface level.
show interface dampening	Displays a summary of the dampening parameters and status.

show interface dampening

To display dampened interfaces on the local router, use the **show interface dampening** command in EXEC mode.

show interface dampening

Syntax Description

This command has no keywords or arguments.

Command Modes

EXEC

Command History

Release	Modification
12.0(22)S	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
12.2(18)SXD	This command was integrated into Cisco IOS Release 12.2(18)SXD.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.

Examples

The following is sample output from the **show interface dampening** command:

```
Router# show interface dampening

Flaps Penalty    Supp ReuseTm   HalfL  ReuseV   SuppV  MaxSTm    MaxP Restart
      0       0   FALSE       0       5    1000    2000      20   16000       0
```

Table 4 describes the significant fields shown in the display.

Table 4 show interface dampening Field Descriptions

Field	Description
Flaps	Displays the number of times that an interface has flapped.
Penalty	Displays the accumulated penalty.
Supp	Indicates if the interface is dampened.
ReuseTm	Displays the reuse timer.
HalfL	Displays the half-life counter.
ReuseV	Displays the reuse threshold timer.
SuppV	Displays the suppress threshold.
MaxSTm	Displays the maximum suppress.
MaxP	Displays the maximum penalty.
Restart	Displays the restart timer.

Related Commands

Command	Description
clear counters	Clears the interface counters.
dampening	Enables IP event dampening at the interface level.
show dampening interface	Displays a summary of interface dampening.

show ip cache policy

To display the cache entries in the policy route cache, use the **show ip cache policy** command in EXEC mode.

show ip cache policy

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.3	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Examples

The following is sample output from the **show ip cache policy** command:

```
Router# show ip cache policy

Total adds 10, total deletes 10

Type Routemap/sequence      Age       Interface       Next Hop
NH   george/10              00:04:31  Ethernet0       192.168.1.2
Int  george/30              00:01:23  Serial4         192.168.5.129
```

Table 5 describes the significant fields shown in the display.

Table 5 show ip cache policy Field Descriptions

Field	Description
Total adds	Number of times a cache entry was created.
total deletes	Number of times a cache entry or the entire cache was deleted.
Type	"NH" indicates the **set ip next-hop** command. "Int" indicates the **set interface** command.
Routemap	Name of the route map that created the entry; in this example, george.
sequence	Route map sequence number.
Age	Age of the cache entry.
Interface	Output interface type and number.
Next Hop	IP address of the next hop.

Related Commands

Command	Description
ip route-cache	Configures the router to export the flow cache entry to a workstation when a flow expires.

show ip local policy

To display the route map used for local policy routing, if any, use the **show ip local policy** command in EXEC mode.

show ip local policy

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.1	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Examples

The following is sample output from the **show ip local policy** command:

```
Router# show ip local policy

Local policy routing is enabled, using route map equal
route-map equal, permit, sequence 10
  Match clauses:
    length 150 200
  Set clauses:
    ip next-hop 10.10.11.254
  Policy routing matches: 0 packets, 0 bytes
route-map equal, permit, sequence 20
  Match clauses:
    ip address (access-lists): 101
  Set clauses:
    ip next-hop 10.10.11.14
  Policy routing matches: 2 packets, 172 bytes
```

Table 6 describes the significant fields shown in the display.

Table 6 show ip local policy Field Descriptions

Field	Description
route-map equal	The name of the route map is equal.
permit	The route map contains permit statements.
sequence	The sequence number of the route map, which determines in what order it is processed among other route maps.
Match clauses:	Clauses in the route map that must be matched to satisfy the permit or deny action.

Table 6 show ip local policy Field Descriptions (continued)

Field	Description
Set clauses:	Set clauses that will be put into place if the match clauses are met.
Policy routing matches: packets	Number of packets that meet the match clauses.
bytes	Number of bytes in the packets that meet the match clauses.

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for local policy routing.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip default next-hop verify-availability	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.

show ip policy

To display the route map used for policy routing, use the **show ip policy** command in user EXEC or privileged EXEC mode.

show ip policy

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.
12.3(7)T	The display output was modified to include a label for dynamic route maps.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Examples

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

```
Router# show ip policy

Interface      Route map
local          equal
Ethernet0/2    equal
Ethernet0/3    AAA-02/06/04-14:01:26.619-1-AppSpec (Dynamic)
```

The following is sample output from the **show route-map** command, which relates to the preceding sample display:

```
Router# show route-map

route-map equal, permit, sequence 10
  Match clauses:
    length 150 200
  Set clauses:
    ip next-hop 10.10.11.254
  Policy routing matches: 0 packets, 0 bytes
route-map equal, permit, sequence 20
  Match clauses:
    ip address (access-lists): 101
  Set clauses:
    ip next-hop 10.10.11.14
  Policy routing matches: 144 packets, 15190 bytes
```

Table 7 describes the significant fields shown in the display.

Table 7 show ip policy Field Descriptions

Field	Description
route-map equal	The name of the route map is equal.
permit	The route map contains permit statements.
sequence	Sequence number of the route map, which determines in what order it is processed among other route maps.
Match clauses	Clauses in the route map that must be matched to satisfy the permit or deny action.
Set clauses	Set clauses that will be put into place if the match clauses are met.
Policy routing matches packets	Number of packets that meet the match clauses.
bytes	Number of bytes in the packets that meet the match clauses.

Related Commands

Command	Description
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match length	Bases policy routing on the Level 3 length of a packet.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set default interface	Indicates where to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
set interface	Indicates where to output packets that pass a match clause of route map for policy routing.
set ip default next-hop verify-availability	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.
set ip next-hop	Indicates where to output packets that pass a match clause of a route map for policy routing.

show ip protocols

To display the parameters and current state of the active routing protocol process, use the **show ip protocols** command in privileged EXEC mode.

show ip protocols

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.2(15)T	Support for the route-hold timer was integrated into the output.
12.2(28)SB	This command was integrated into Cisco IOS 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

The information displayed by the **show ip protocols** command is useful in debugging routing operations. Information in the Routing Information Sources field of the **show ip protocols** output can help you identify a router suspected of delivering bad routing information.

Examples

EIGRP Example

The following is sample output from the **show ip protocols** command that shows EIGRP process 77:

```
Router# show ip protocols

Routing Protocol is "eigrp 77"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: eigrp 77
  Automatic network summarization is in effect
  Routing for Networks:
    192.168.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.81.28          90      0:02:36
    192.168.80.28          90      0:03:04
    192.168.80.31          90      0:03:04
  Distance: internal 90 external 170
```

Table 8 describes the significant fields shown in the display.

Table 8 show ip protocols Field Descriptions for Enhanced IGRP Process 77

Field	Description
Routing Protocol is “eigrp 77”	Name and autonomous system number of the currently running routing protocol.
Outgoing update filter list for all interfaces...	Indicates whether a filter for outgoing routing updates has been specified with the **distribute-list out** command.
Incoming update filter list for all interfaces...	Indicates whether a filter for incoming routing updates has been specified with the **distribute-list in** command.
Redistributing: eigrp 77	Indicates whether route redistribution has been enabled with the **redistribute** command.
Automatic network summarization...	Indicates whether route summarization has been enabled with the **auto-summary** command.
Routing for Networks:	Networks for which the routing process is currently injecting routes.
Routing Information Sources:	Lists all the routing sources that the Cisco IOS software is using to build its routing table. The following is displayed for each source: • IP address • Administrative distance • Time the last update was received from this source
Distance: internal 90 external 170	Internal and external distances of the router. Internal distance is the degree of preference given to EIGRP internal routes. External distance is the degree of preference given to EIGRP external routes.

IS-IS Example

The following is sample output from the **show ip protocols** command that shows an Intermediate System-to-Intermediate System (IS-IS) process:

```
Router# show ip protocols

Routing Protocol is "isis"
  Sending updates every 0 seconds
  Invalid after 0 seconds, hold down 0, flushed after 0
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: isis
  Address Summarization:
    None
  Routing for Networks:
    Serial0
  Routing Information Sources:
  Distance: (default is 115)
```

Table 9 describes the significant fields shown in the display.

Table 9 show ip protocols Field Descriptions for an IS-IS Process

Field	Description
Routing Protocol is “isis”	Specifies the routing protocol used.
Sending updates every 0 seconds	Specifies the time between sending updates.
Invalid after 0 seconds	Specifies the value of the invalid parameter.
hold down 0	Specifies the current value of the hold-down parameter.
flushed after 0	Specifies the time (in seconds) after which the individual routing information will be thrown out (flushed).
Outgoing update ...	Specifies whether the outgoing filtering list has been set.
Incoming update ...	Specifies whether the incoming filtering list has been set.
Default networks	Specifies how these networks will be handled in both incoming and outgoing updates.
Redistributing	Lists the protocol that is being redistributed.
Routing	Specifies the networks for which the routing process is currently injecting routes.
Routing Information Sources	Lists all the routing sources the Cisco IOS software is using to build its routing table. For each source, you will see the following displayed: • IP address • Administrative distance • Time the last update was received from this source

RIP Example

The following is sample output from the **show ip protocols** command that shows Routing Information Protocol (RIP) processes:

```
Router# show ip protocols

Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 2 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface         Send  Recv   Key-chain
    Ethernet0         2     2      trees
    Fddi0             2     2
  Routing for Networks:
    172.19.0.0
    10.2.0.0
    10.3.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: (default is 120)
```

Table 10 describes the significant fields shown in the display.

Table 10 show ip protocols Field Descriptions for a RIP Process

Field	Description
Routing Protocol is “rip”	Specifies the routing protocol used.
Sending updates every 30 seconds	Specifies the time between sending updates.
next due in 2 seconds	Precisely when the next update is due to be sent.
Invalid after 180 seconds	Specifies the value of the invalid parameter.
hold down for 180	Specifies the current value of the hold-down parameter.
flushed after 240	Specifies the time (in seconds) after which the individual routing information will be thrown (flushed) out.
Outgoing update ...	Specifies whether the outgoing filtering list has been set.
Incoming update ...	Specifies whether the incoming filtering list has been set.
Default version control:	Specifies the version of RIP packets that are sent and received.
Redistributing	Lists the protocol that is being redistributed.
Routing	Specifies the networks for which the routing process is currently injecting routes.
Routing Information Sources	Lists all the routing sources the Cisco IOS software is using to build its routing table. For each source, you will see the following displayed: • IP address • Administrative distance • Time the last update was received from this source

EIGRP NSF Awareness Verification Example

The following is sample output from the **show ip protocols** command. The output shows that the router is running EIGRP, is NSF-aware, and that the route-hold timer is set 240 seconds, which is the default value for the route-hold timer.

```
Router# show ip protocols

Routing Protocol is "eigrp 101"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
  Redistributing: eigrp 101
  EIGRP NSF-aware route hold timer is 240s
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
    10.4.9.0/24
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: internal 90 external 170
```

Table 11 describes the significant fields shown in the display.

Table 11 show ip protocols Field Descriptions for an EIGRP NSF-Aware Process

Field	Description
Routing Protocol is “eigrp 101”	Specifies the routing protocol used.
Outgoing update ...	Specifies whether the outgoing filtering list has been set.
Incoming update ...	Specifies whether the incoming filtering list has been set.
Default networks...	Specifies how these networks will be handled in both incoming and outgoing updates.
EIGRP...	Specifies the value of the K0-K5 metrics, and the maximum hop count.
Redistributing	Lists the protocol that is being redistributed.
EIGRP NSF-Aware...	Displays the route-hold timer value.
Automatic network summarization...	Specifies that automatic summarization is enabled.
Routing	Specifies the networks for which the routing process is currently injecting routes.
Routing Information Sources	Lists all the routing sources the Cisco IOS software is using to build its routing table. For each source, you will see the following displayed: • IP address • Administrative distance • Time the last update was received from this source

show ip route

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

show ip route [*ip-address* [**repair-paths** | **next-hop-override** [**dhcp**] | *mask* [**longer-prefixes**]] | *protocol* [*process-id*] | **list** [*access-list-number* | *access-list-name*] | **static download** | **update-queue**]

Syntax Description

ip-address	(Optional) IP address about which routing information should be displayed.
repair-paths	(Optional) Displays the repair paths.
next-hop-override	(Optional) Displays the next hop overrides (NHRP) associated with a particular route, along with the corresponding default next hops.
dhcp	(Optional) Displays routes added by the Dynamic Host Configuration Protocol (DHCP) server.
mask	(Optional) The subnet mask.
longer-prefixes	(Optional) Specifies that only routes matching the *ip-address* and *mask* pair should be displayed.
protocol	(Optional) The name of a routing protocol, or the keyword **connected**, **mobile**, **static**, or **summary**. If you specify a routing protocol, use one of the following keywords: **bgp**, **eigrp**, **hello**, **isis**, **odr**, **ospf**, **nhr**, and **rip**.
process-id	(Optional) The number used to identify a process of the specified protocol.
list	(Optional) Filters output by an access list name or number.
access-list-number	(Optional) Specific access list number for which output from the routing table should be displayed.
access-list-name	(Optional) Specific access list name for which output from the routing table should be displayed.
static	(Optional) Displays static routes.
download	(Optional) Displays route installed using the Authentication, Authorization, and Accounting (AAA) route download function. This keyword is used only when AAA is configured.
update-queue	(Optional) Displays Routing Information Base (RIB) queue updates.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
9.2	This command was introduced.
10.0	The “D—EIGRP, EX—EIGRP, N1—OSPF NSSA external type 1 route” and “N2—OSPF NSSA external type 2 route” codes were added to the command output.

Release	Modification
10.3	The *process-id* argument was added.
11.0	The **longer-prefixes** keyword was added.
11.1	The "U—per-user static route" code was added to the command output.
11.2	The "o—on-demand routing" code was added to the command output.
12.2(33)SRA	This command was modified. The **update-queue** keyword was added.
11.3	The output from the **show ip route** *ip-address* command was enhanced to display the origination of an IP route in Intermediate System-to-Intermediate System (IS-IS) networks.
12.0(1)T	The "M—mobile" code was added to the command output.
12.0(3)T	The "P—periodic downloaded static route" code was added to the command output.
12.0(4)T	The "ia—IS-IS" code was added to the command output.
12.2(2)T	The output from the **show ip route** *ip-address* command was enhanced to display information on the multipaths to the specified network.
12.2(13)T	The *egp* and *igrp* arguments were removed because the exterior gateway protocol (EGP) and the Interior Gateway Routing Protocol (IGRP) are no longer available in Cisco IOS software.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(14)SX	This command was integrated into Cisco IOS Release 12.2(14)SX.
12.3(2)T	The output was enhanced to display route tag information.
12.3(8)T	The output was enhanced to display static routes using DHCP.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRE	This command was modified. The **dhcp** and **repair-paths** keywords were added. Support for the Border Gateway Protocol (BGP) best external and BGP additional path features was added.
12.2(33)XNE	This command was integrated into Cisco IOS Release 12.2(33)XNE.
Cisco IOS XE Release 2.5	This command was modified. The **next-hop-override** and **nhrp** keywords were added.

Usage Guidelines

The **show ip route static download** command provides a way to display all dynamic static routes with name and distance information, including active and inactive ones. You can display all active dynamic static routes with both the **show ip route** and **show ip route static** commands after these active routes are added in the main routing table.

Examples

Routing Table Examples

The following examples show the standard routing tables displayed by the **show ip route** command. Use the codes displayed at the beginning of each report and the information in Table 12 to understand the type of route.

The following is sample output from the **show ip route** command when entered without an address:

```
Router# show ip route

Codes: R - RIP derived, O - OSPF derived,
```

```
       C - connected, S - static, B - BGP derived,
       * - candidate default route, IA - OSPF inter area route,
       i - IS-IS derived, ia - IS-IS, U - per-user static route,
       o - on-demand routing, M - mobile, P - periodic downloaded static route,
       D - EIGRP, EX - EIGRP external, E1 - OSPF external type 1 route,
       E2 - OSPF external type 2 route, N1 - OSPF NSSA external type 1 route,
       N2 - OSPF NSSA external type 2 route

Gateway of last resort is 10.119.254.240 to network 10.140.0.0

O E2 10.110.0.0 [160/5] via 10.119.254.6, 0:01:00, Ethernet2
E    10.67.10.0 [200/128] via 10.119.254.244, 0:02:22, Ethernet2
O E2 10.68.132.0 [160/5] via 10.119.254.6, 0:00:59, Ethernet2
O E2 10.130.0.0 [160/5] via 10.119.254.6, 0:00:59, Ethernet2
E    10.128.0.0 [200/128] via 10.119.254.244, 0:02:22, Ethernet2
E    10.129.0.0 [200/129] via 10.119.254.240, 0:02:22, Ethernet2
E    10.65.129.0 [200/128] via 10.119.254.244, 0:02:22, Ethernet2
E    10.10.0.0 [200/128] via 10.119.254.244, 0:02:22, Ethernet2
E    10.75.139.0 [200/129] via 10.119.254.240, 0:02:23, Ethernet2
E    10.16.208.0 [200/128] via 10.119.254.244, 0:02:22, Ethernet2
E    10.84.148.0 [200/129] via 10.119.254.240, 0:02:23, Ethernet2
E    10.31.223.0 [200/128] via 10.119.254.244, 0:02:22, Ethernet2
E    10.44.236.0 [200/129] via 10.119.254.240, 0:02:23, Ethernet2
E    10.141.0.0 [200/129] via 10.119.254.240, 0:02:22, Ethernet2
E    10.140.0.0 [200/129] via 10.119.254.240, 0:02:23, Ethernet2
```

The following is sample output that includes IS-IS Level 2 routes learned:

```
Router# show ip route

Codes: R - RIP derived, O - OSPF derived,
       C - connected, S - static, B - BGP derived,
       * - candidate default route, IA - OSPF inter area route,
       i - IS-IS derived, ia - IS-IS, U - per-user static route,
       o - on-demand routing, M - mobile, P - periodic downloaded static route,
       D - EIGRP, EX - EIGRP external, E1 - OSPF external type 1 route,
       E2 - OSPF external type 2 route, N1 - OSPF NSSA external type 1 route,
       N2 - OSPF NSSA external type 2 route

Gateway of last resort is not set

     10.89.0.0 is subnetted (mask is 255.255.255.0), 3 subnets
C       10.89.64.0 255.255.255.0 is possibly down,
          routing via 0.0.0.0, Ethernet0
i L2    10.89.67.0 [115/20] via 10.89.64.240, 0:00:12, Ethernet0
i L2    10.89.66.0 [115/20] via 10.89.64.240, 0:00:12, Ethernet0
```

The following is sample output using the **longer-prefixes** keyword. When the **longer-prefixes** keyword is included, the address and mask pair becomes the prefix, and any address that matches that prefix is displayed. Therefore, multiple addresses are displayed.

In the following example, the logical AND operation is performed on the source address 10.0.0.0 and the mask 10.0.0.0, resulting in 10.0.0.0. Each destination in the routing table is also logically ANDed with the mask and compared to that result of 10.0.0.0. Any destinations that fall into that range are displayed in the output.

```
Router# show ip route 10.0.0.0 10.0.0.0 longer-prefixes

Codes: R - RIP derived, O - OSPF derived,
       C - connected, S - static, B - BGP derived,
       * - candidate default route, IA - OSPF inter area route,
       i - IS-IS derived, ia - IS-IS, U - per-user static route,
       o - on-demand routing, M - mobile, P - periodic downloaded static route,
       D - EIGRP, EX - EIGRP external, E1 - OSPF external type 1 route,
```

```
       E2 - OSPF external type 2 route, N1 - OSPF NSSA external type 1 route,
       N2 - OSPF NSSA external type 2 route

Gateway of last resort is not set

S    10.134.0.0 is directly connected, Ethernet0
S    10.10.0.0 is directly connected, Ethernet0
S    10.129.0.0 is directly connected, Ethernet0
S    10.128.0.0 is directly connected, Ethernet0
S    10.49.246.0 is directly connected, Ethernet0
S    10.160.97.0 is directly connected, Ethernet0
S    10.153.88.0 is directly connected, Ethernet0
S    10.76.141.0 is directly connected, Ethernet0
S    10.75.138.0 is directly connected, Ethernet0
S    10.44.237.0 is directly connected, Ethernet0
S    10.31.222.0 is directly connected, Ethernet0
S    10.16.209.0 is directly connected, Ethernet0
S    10.145.0.0 is directly connected, Ethernet0
S    10.141.0.0 is directly connected, Ethernet0
S    10.138.0.0 is directly connected, Ethernet0
S    10.128.0.0 is directly connected, Ethernet0
     10.19.0.0 255.255.255.0 is subnetted, 1 subnets
C       10.19.64.0 is directly connected, Ethernet0
     10.69.0.0 is variably subnetted, 2 subnets, 2 masks
C       10.69.232.32 255.255.255.240 is directly connected, Ethernet0
S       10.69.0.0 255.255.0.0 is directly connected, Ethernet0
```

The following examples display all downloaded static routes. A P designates which route was installed using AAA route download.

```
Router# show ip route

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is 172.21.17.1 to network 0.0.0.0

        172.31.0.0/32 is subnetted, 1 subnets
P       172.31.229.41 is directly connected, Dialer1 20.0.0.0/24 is subnetted, 3 subnets
P       10.1.1.0 [200/0] via 172.31.229.41, Dialer1
P       10.1.3.0 [200/0] via 172.31.229.41, Dialer1
P       10.1.2.0 [200/0] via 172.31.229.41, Dialer1

Router# show ip route static

     172.27.4.0/8 is variably subnetted, 2 subnets, 2 masks
P       172.16.1.1/32 is directly connected, BRI0
P       172.27.4.0/8 [1/0] via 10.1.1.1, BRI0
S    172.31.0.0/16 [1/0] via 172.21.114.65, Ethernet0
S    10.0.0.0/8 is directly connected, BRI0
P    10.0.0.0/8 is directly connected, BRI0
     172.21.0.0/16 is variably subnetted, 5 subnets, 2 masks
S       172.21.114.201/32 is directly connected, BRI0
S       172.21.114.205/32 is directly connected, BRI0
S       172.21.114.174/32 is directly connected, BRI0
S       172.21.114.12/32 is directly connected, BRI0
P    10.0.0.0/8 is directly connected, BRI0
P    10.1.0.0/16 is directly connected, BRI0
P    10.2.2.0/24 is directly connected, BRI0
```

```
S*   0.0.0.0/0 [1/0] via 172.21.114.65, Ethernet0
S    172.29.0.0/16 [1/0] via 172.21.114.65, Ethernet0
```

The following example shows how to use the **show ip route static download** command to display all active and inactive routes installed using AAA route download:

```
Router# show ip route static download

Connectivity: A - Active, I - Inactive

A     10.10.0.0 255.0.0.0 BRI0
A     10.11.0.0 255.0.0.0 BRI0
A     10.12.0.0 255.0.0.0 BRI0
A     10.13.0.0 255.0.0.0 BRI0
I     10.20.0.0 255.0.0.0 172.21.1.1
I     10.22.0.0 255.0.0.0 Serial0
I     10.30.0.0 255.0.0.0 Serial0
I     10.31.0.0 255.0.0.0 Serial1
I     10.32.0.0 255.0.0.0 Serial1
A     10.34.0.0 255.0.0.0 192.168.1.1
A     10.36.1.1 255.255.255.255 BRI0 200 name remote1
I     10.38.1.9 255.255.255.0 192.168.69.1
```

The following example shows how to use the **show ip route nhrp** command to enable shortcut switching on the tunnel interface:

```
Router# show ip route

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP

Gateway of last resort is not set

       10.0.0.0/16 is variably subnetted, 3 subnets, 2 masks
C       10.1.1.0/24 is directly connected, Tunnel0
C       172.16.22.0 is directly connected, Ethernet1/0
H       172.16.99.0 [250/1] via 10.1.1.99, 00:11:43, Tunnel0
     10.11.0.0/24 is subnetted, 1 subnets
C       10.11.11.0 is directly connected, Ethernet0/0

Router# show ip route nhrp

H       172.16.99.0 [250/1] via 10.1.1.99, 00:11:43, Tunnel0
```

The following is sample output using the **next-hop-override** keyword. When the **next-hop-override** keyword is included, the NHRP Nexthop-overrides associated with a particular route, along with the corresponding default next hops, are displayed.

```
================================================================
1) Initial configuration
================================================================
Router# show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
```

```
       o - ODR, P - periodic downloaded static route, H - NHRP
       + - replicated route

Gateway of last resort is not set

      10.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        10.2.1.0/24 is directly connected, Loopback1
L        10.2.1.1/32 is directly connected, Loopback1
      10.0.0.0/24 is subnetted, 1 subnets
S        10.10.10.0 is directly connected, Tunnel0
      10.11.0.0/24 is subnetted, 1 subnets
S        10.11.11.0 is directly connected, Ethernet0/0

Router# show ip route next-hop-override

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP
       + - replicated route

Gateway of last resort is not set

      10.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        10.2.1.0/24 is directly connected, Loopback1
L        10.2.1.1/32 is directly connected, Loopback1
      10.0.0.0/24 is subnetted, 1 subnets
S        10.10.10.0 is directly connected, Tunnel0
      10.11.0.0/24 is subnetted, 1 subnets
S        10.11.11.0 is directly connected, Ethernet0/0

Router# show ip cef

Prefix              Next Hop            Interface
.
.
.
10.2.1.255/32        receive             Loopback1
10.10.10.0/24       attached            Tunnel0  <<<<<<<<
10.11.11.0/24       attached            Ethernet0/0
127.0.0.0/8         drop
.
.
.
================================================================
2) Add a Nexthop-override
    address = 10.10.10.0
    mask = 255.255.255.0
    gateway = 10.1.1.1
    interface = Tunnel0
================================================================
Router# show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP
       + - replicated route
```

```
Gateway of last resort is not set

      10.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        10.2.1.0/24 is directly connected, Loopback1
L        10.2.1.1/32 is directly connected, Loopback1
      10.0.0.0/24 is subnetted, 1 subnets
% S        10.10.10.0 is directly connected, Tunnel0
      10.11.0.0/24 is subnetted, 1 subnets
S        10.11.11.0 is directly connected, Ethernet0/0

Router# show ip route next-hop-override

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP
       + - replicated route

Gateway of last resort is not set

      10.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        10.2.1.0/24 is directly connected, Loopback1
L        10.2.1.1/32 is directly connected, Loopback1
      10.0.0.0/24 is subnetted, 1 subnets
% S        10.10.10.0 is directly connected, Tunnel0
                  [NHO][1/0] via 10.1.1.1, Tunnel0
      10.11.0.0/24 is subnetted, 1 subnets
S        10.11.11.0 is directly connected, Ethernet0/0

Router# show ip cef

Prefix               Next Hop             Interface
.
.
.
10.2.1.255/32         receive              Loopback110.10.10.0/24

10.10.10.0/24       10.1.1.1              Tunnel0
10.11.11.0/24       attached            Ethernet0/0
10.12.0.0/16 drop
.
.
.

============================================================
3) Delete a Nexthop-override
    address = 10.10.10.0
    mask = 255.255.255.0
    gateway = 10.11.1.1
    interface = Tunnel0
============================================================
Router# show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP
```

```
       + - replicated route

Gateway of last resort is not set

      10.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        10.2.1.0/24 is directly connected, Loopback1
L        10.2.1.1/32 is directly connected, Loopback1
      10.0.0.0/24 is subnetted, 1 subnets
S        10.10.10.0 is directly connected, Tunnel0
      10.11.0.0/24 is subnetted, 1 subnets
S        10.11.11.0 is directly connected, Ethernet0/0

Router# show ip route next-hop-override

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP
       + - replicated route

Gateway of last resort is not set

      10.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        10.2.1.0/24 is directly connected, Loopback1
L        10.2.1.1/32 is directly connected, Loopback1
      10.0.0.0/24 is subnetted, 1 subnets
S        10.10.10.0 is directly connected, Tunnel0
      10.11.0.0/24 is subnetted, 1 subnets
S        10.11.11.0 is directly connected, Ethernet0/0

Router# show ip cef

Prefix               Next Hop             Interface
.
.
.
10.2.1.255/32         receive              Loopback110.10.10.0/24

10.10.10.0/24        attached             Tunnel0
10.11.11.0/24        attached             Ethernet0/0
10.120.0.0/16 drop
.
.
.
```

Table 12 show ip route Field Descriptions

Field	Description
Codes	Indicates the protocol that derived the route. It can be one of the following values: • B— BGP derived • C—connected • D—Enhanced Interior Gateway Routing Protocol (EIGRP) • EX—EIGRP external • H— NHRP • i—IS-IS derived • ia—IS-IS • L—local • M—mobile • O—Open Shortest Path First (OSPF) derived • P—periodic downloaded static route • R—Routing Information Protocol (RIP) derived • S—static • U—per-user static route • o—on-demand routing • +—replicated route
Codes	Type of route. It can be one of the following values: *—Indicates the last path used when a packet was forwarded. It pertains only to the nonfast-switched packets. However, it does not indicate which path will be used next when forwarding a nonfast-switched packet, except when the paths are equal cost. • E1—OSPF external type 1 route • E2—OSPF external type 2 route • IA—OSPF inter area route • L1—IS-IS Level 1 route • L2—IS-IS Level 2 route • N1—OSPF not-so-stubby area (NSSA) external type 1 route • N2—OSPF NSSA external type 2 route
10.110.0.0	Indicates the address of the remote network.
[160/5]	The first number in the brackets is the administrative distance of the information source; the second number is the metric for the route.
via 10.119.254.6	Specifies the address of the next router to the remote network.
0:01:00	Specifies the last time the route was updated (in hours:minutes:seconds).
Ethernet2	Specifies the interface through which the specified network can be reached.

Specific Route Information

When you specify that you want information about a specific network displayed, more detailed statistics are shown. The following is sample output from the **show ip route** command when entered with the IP address 10.0.0.1:

```
Router# show ip route 10.0.0.1

Routing entry for 10.0.0.1/32
    Known via "isis", distance 115, metric 20, type level-1
    Redistributing via isis
    Last update from 10.191.255.251 on Fddi1/0, 00:00:13 ago
    Routing Descriptor Blocks:
    * 10.22.22.2, from 10.191.255.247, via Serial2/3
       Route metric is 20, traffic share count is 1
       10.191.255.251, from 10.191.255.247, via Fddi1/0
       Route metric is 20, traffic share count is 1
```

When an IS-IS router advertises its link-state information, it includes one of its own IP addresses to be used as the originator IP address. When other routers calculate IP routes, they can store the originator IP address with each route in the routing table.

The preceding example shows the output from the **show ip route** command for an IP route generated by IS-IS. Each path that is shown under the Routing Descriptor Blocks report displays two IP addresses. The first address (10.22.22.2) is the next hop address. The second is the originator IP address from the advertising IS-IS router. This address helps you determine where a particular IP route has originated in your network. In the example the route to 10.0.0.1/32 was originated by a router with IP address 10.191.255.247.

Table 13 describes the significant fields shown when using the **show ip route** command with an IP address.

Table 13 show ip route with IP Address Field Descriptions

Field	Description
Routing entry for 10.0.0.1/32	Network number and mask.
Known via...	Indicates how the route was derived.
Tag	Integer that is used to implement the route.
type	Indicates the IS-IS route type (Level 1 or Level 2).
Redistributing via...	Indicates the redistribution protocol.
Last update from 10.191.255.251	Indicates the IP address of a router that is the next hop to the remote network and the router interface on which the last update arrived.
Routing Descriptor Blocks:	Displays the next hop IP address followed by the information source.
Route metric	This value is the best metric for this routing descriptor block.
traffic share count	Number of uses for this routing descriptor block.

The following is sample output using the **longer-prefixes** keyword. When the **longer-prefixes** keyword is included, the address and mask pair becomes the prefix, and any address that matches that prefix is displayed. Therefore, multiple addresses are displayed.

In the following example, the logical AND operation is performed on the source address 10.0.0.0 and the mask 10.0.0.0, resulting in 10.0.0.0. Each destination in the routing table is also logically ANDed with the mask and compared to that result of 10.0.0.0. Any destinations that fall into that range are displayed in the output.

```
Router# show ip route 10.0.0.0 10.0.0.0 longer-prefixes

Codes: R - RIP derived, O - OSPF derived,
       C - connected, S - static, B - BGP derived,
       * - candidate default route, IA - OSPF inter area route,
       i - IS-IS derived, ia - IS-IS, U - per-user static route,
       o - on-demand routing, M - mobile, P - periodic downloaded static route,
       D - EIGRP, EX - EIGRP external, E1 - OSPF external type 1 route,
       E2 - OSPF external type 2 route, N1 - OSPF NSSA external type 1 route,
       N2 - OSPF NSSA external type 2 route

Gateway of last resort is not set

S    10.134.0.0 is directly connected, Ethernet0
S    10.10.0.0 is directly connected, Ethernet0
S    10.129.0.0 is directly connected, Ethernet0
S    10.128.0.0 is directly connected, Ethernet0
S    10.49.246.0 is directly connected, Ethernet0
S    10.160.97.0 is directly connected, Ethernet0
S    10.153.88.0 is directly connected, Ethernet0
S    10.76.141.0 is directly connected, Ethernet0
S    10.75.138.0 is directly connected, Ethernet0
S    10.44.237.0 is directly connected, Ethernet0
S    10.31.222.0 is directly connected, Ethernet0
S    10.16.209.0 is directly connected, Ethernet0
S    10.145.0.0 is directly connected, Ethernet0
S    10.141.0.0 is directly connected, Ethernet0
S    10.138.0.0 is directly connected, Ethernet0
S    10.128.0.0 is directly connected, Ethernet0
     10.19.0.0 255.255.255.0 is subnetted, 1 subnets
C       10.19.64.0 is directly connected, Ethernet0
     10.69.0.0 is variably subnetted, 2 subnets, 2 masks
C       10.69.232.32 255.255.255.240 is directly connected, Ethernet0
S       10.69.0.0 255.255.0.0 is directly connected, Ethernet0
```

The following output includes the tag 120 applied to the route 10.22.0.0/16. You must specify an IP prefix in order to see the tag value.

```
Router# show ip route 10.22.0.0

Routing entry for 10.22.0.0/16
  Known via "isis", distance 115, metric 12
  Tag 120, type level-1
  Redistributing via isis
  Last update from 172.19.170.12 on Ethernet2, 01:29:13 ago
  Routing Descriptor Blocks:
    * 172.19.170.12, from 10.3.3.3, via Ethernet2
        Route metric is 12, traffic share count is 1
        Route tag 120
```

Static Routes Using a DHCP Gateway Examples

The following example shows that IP route 10.8.8.0 is directly connected to the Internet and is the next-hop (option 3) default gateway. Routes 10.1.1.1 [1/0], 10.3.2.1 [24/0], and 172.2.2.2 [1/0] are static, and route 10.0.0.0/0 is a default route candidate.

```
Router# show ip route

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
```

```
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 10.0.19.14 to network 0.0.0.0

10.0.0.0/24 is subnetted, 1 subnets
C 10.8.8.0 is directly connected, Ethernet1
  10.0.0.0/32 is subnetted, 1 subnets
S 10.1.1.1 [1/0] via 10.8.8.1
  10.0.0.0/32 is subnetted, 1 subnets
S 10.3.2.1 [24/0] via 10.8.8.1
  172.16.0.0/32 is subnetted, 1 subnets
S 172.2.2.2 [1/0] via 10.8.8.1
  10.0.0.0/28 is subnetted, 1 subnets
C 10.0.19.0 is directly connected, Ethernet0
  10.0.0.0/24 is subnetted, 1 subnets
C 10.15.15.0 is directly connected, Loopback0

S* 10.0.0.0/0 [1/0] via 10.0.19.14
```

The following sample output from the **show ip route repair-paths** command shows the repair paths marked with the tag [RPR]:

```
Router# show ip route repair-paths

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      10.0.0.0/32 is subnetted, 3 subnets
C        10.1.1.1 is directly connected, Loopback0
B        10.2.2.2 [200/0] via 172.16.1.2, 00:31:07
                  [RPR][200/0] via 192.168.1.2, 00:31:07
B        10.9.9.9 [20/0] via 192.168.1.2, 00:29:45
                  [RPR][20/0] via 192.168.3.2, 00:29:45
      172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.16.1.0/24 is directly connected, Ethernet0/0
L        172.16.1.1/32 is directly connected, Ethernet0/0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, Serial2/0
L        192.168.1.1/32 is directly connected, Serial2/0
B     192.168.3.0/24 [200/0] via 172.16.1.2, 00:31:07
                     [RPR][200/0] via 192.168.1.2, 00:31:07
B     192.168.9.0/24 [20/0] via 192.168.1.2, 00:29:45
                     [RPR][20/0] via 192.168.3.2, 00:29:45
B     192.168.13.0/24 [20/0] via 192.168.1.2, 00:29:45
                      [RPR][20/0] via 192.168.3.2, 00:29:45

Router# show ip route repair-paths 10.9.9.9

>Routing entry for 10.9.9.9/32
>  Known via "bgp 100", distance 20, metric 0
>  Tag 10, type external
```

```
>  Last update from 192.168.1.2 00:44:52 ago
>  Routing Descriptor Blocks:
>  * 192.168.1.2, from 192.168.1.2, 00:44:52 ago, recursive-via-conn
>      Route metric is 0, traffic share count is 1
>      AS Hops 2
>      Route tag 10
>      MPLS label: none
>    [RPR]192.168.3.2, from 172.16.1.2, 00:44:52 ago
>      Route metric is 0, traffic share count is 1
>      AS Hops 2
>      Route tag 10
>      MPLS label: none
```

Related Commands

Command	Description
show dialer	Displays general diagnostic information for interfaces configured for DDR.
show interfaces tunnel	Displays a list of tunnel interface information.
show ip route summary	Displays the current state of the routing table in summary format.

show ip route loops

To display all routes currently in the routing information base (RIB) that are part of a loop, use the **show ip route loops** command in user EXEC or privileged EXEC mode.

show ip route loops

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)M	This command was introduced.

Usage Guidelines

Use the **show ip route loops** command to display information about all routes currently in the RIB that are part of a loop.

For example, the following configuration introduces a loop in the RIB that cannot be safely resolved without the risk of oscillation.

```
ip route 0.0.0.0 0.0.0.0 192.168.5.6
ip route 192.168.0.0 255.255.0.0 192.168.1.2
```

Note The above configuration is not useful. The same forwarding behavior can be achieved if you configure **ip route 0.0.0.0 0.0.0.0 192.168.1.2**.

When the connected route for 192.168.1.2/30 is removed, loop is introduced and the following log message is displayed:

```
*Mar 31 15:50:16.307: %IPRT-3-RIB_LOOP: Resolution loop formed by routes in RIB
```

You can use the **show ip route loops** command to view information about this loop.

Examples

The following is sample output from the **show ip route loops** command. The fields are self-explanatory.

```
Router# show ip route loops

default:ipv4:base 192.168.0.0/16 -> base 192.168.1.2 static 00:56:46
default:ipv4:base 0.0.0.0/0 -> base 192.168.5.6 static 00:56:46 N
```

Related Commands

Command	Description
ip route	Establishes static routes.

show ip route profile

To display routing table change statistics, use the **show ip route profile** command in EXEC mode.

show ip route profile

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
12.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

Use this command in combination with the **ip route profile** global configuration command to validate the routing table change statistics.

Examples

The following example shows the frequency of routing table changes in a 5-second sampling interval. In this example, the Prefix add change occurred 22 times in one interval and 24 times in another interval. The output represents this with a Fwd-path change value of 2 and a Prefix add value of 2:

```
Router# show ip route profile

-----------------------------------------------------------------------
Change/    Fwd-path    Prefix    Nexthop    Pathcount    Prefix
interval   change       add       Change      Change        refresh
-----------------------------------------------------------------------
0           87           87         89          89            89
1           0            0          0           0             0
2           0            0          0           0             0
3           0            0          0           0             0
4           0            0          0           0             0
5           0            0          0           0             0
10          0            0          0           0             0
15          0            0          0           0             0
20          2            2          0           0             0
25          0            0          0           0             0
```

Table 14 describes the significant fields shown in the display.

Table 14 show ip route profile Field Descriptions

Field	Description
Change/interval	Represents the frequency buckets. A Change/interval of 20 represents the bucket that is incremented when a particular event occurs 20 times in a sampling interval. It is very common to see high counters for the Change/interval bucket for 0. This counter represents the number of sampling intervals in which there were no changes to the routing table. Route removals are not counted in the statistics, only route additions.
Fwd-path change	Number of changes in the forwarding path. This value represents the accumulation of Prefix add, Nexthop change, and Pathcount change.
Prefix add	A new prefix was added to the routing table.
Nexthop change	A prefix is not added or removed, but the next hop changes. This statistic is only seen with recursive routes that are installed in the routing table.
Pathcount change	The number of paths in the routing table has changed. This change is the result of an increase in the number of paths for an Interior Gateway Protocol (IGP).
Prefix refresh	Indicates standard routing table maintenance. The forwarding behavior was not changed.

Related Commands

Command	Description
ip route profile	Enables IP routing table statistics collection

show ip route summary

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

show ip route summary

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged 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.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

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 15 describes the significant fields shown in the display.

Table 15 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.

Table 15 show ip route summary Field Descriptions (continued)

Field	Description
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.
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.

show ip route supernets-only

To display information about supernets, use the **show ip route supernets-only** command in privileged EXEC mode.

show ip route supernets-only

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Examples

The following is sample output from the **show ip route supernets-only** command. This display shows supernets only; it does not show subnets.

```
Router# show ip route supernets-only

Codes: R - RIP derived, O - OSPF derived
       C - connected, S - static, B - BGP derived
       i - IS-IS derived, D - EIGRP derived
       * - candidate default route, IA - OSPF inter area route
       E1 - OSPF external type 1 route, E2 - OSPF external type 2 route
       L1 - IS-IS level-1 route, L2 - IS-IS level-2 route
       EX - EIGRP external route

Gateway of last resort is not set

B    172.16.0.0 (mask is 255.255.0.0) [20/0] via 172.16.72.30, 0:00:50
B    192.0.0.0 (mask is 255.0.0.0) [20/0] via 172.16.72.24, 0:02:50
```

Table 16 describes the significant fields shown in the display.

Table 16 show ip route supernets-only Field Descriptions

Field	Description
B	Border Gateway Protocol (BGP) derived, as shown in list of codes.
172.16.0.0 (mask is 255.255.0.0)	Supernet IP address.
[20/0]	Administrative distance (external/internal).

Table 16 show ip route supernets-only Field Descriptions

Field	Description
via 172.16.72.30	Next hop IP address.
0:00:50	Age of the route (how long ago the update was received).

show ip route track-table

To display information about the IP route track table, use the **show ip route track-table** command in privileged EXEC mode.

show ip route track-table

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.3(2)XE	This command was introduced.
12.3(8)T	This command was integrated into Cisco IOS Release 12.3(8)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.

Examples

The following example displays information about the IP route track table:

```
Router# show ip route track-table

ip route 0.0.0.0 0.0.0.0 10.1.1.242 track-object 123 state is [up]
```

Table 17 describes the significant fields shown in the display.

Table 17 show ip route track-table Field Descriptions

Field	Description
ip route	The configured IP route.
track-object	The track object number.
state is	The state of the track object. The object may be up or down.

show ip static route

To display the static process local Routing Information Base (RIB) information, use the **show ip static route** command in user EXEC or privileged EXEC configuration mode.

show ip static route [**bfd**] [**vrf** *vrf-name*] [**topology** *topology-name*] [*ip-address* [*mask*]] [**multicast**] [**summary**]

Syntax Description

bfd	(Optional) Displays IPv4 static Bidirectional Forwarding Detection (BFD) neighbor information.
vrf *vrf-name*	(Optional) Name of the VRF by which static routing information should be displayed.
topology *topology-name*	(Optional) Static route information for the specified topology.
ip-address	(Optional) Address by which static routing information should be displayed.
mask	(Optional) Subnet mask.
multicast	(Optional) Displays IPv4 multicast information.
summary	(Optional) Displays summary information.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
12.2(33)SRB	This command was introduced.
12.2(33)SRC	The command output was enhanced to include BFD neighbor information.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.

Examples

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

```
Router# show ip static route

Codes: M - Manual static, A - AAA download, N - IP NAT, D - DHCP,
       G - GPRS, V - Crypto VPN, C - CASA, P - Channel interface processor,
       B - BootP, S - Service selection gateway
       DN - Default Network, T - Tracking object
       L - TL1, E - OER
Codes in []: A - active, N - non-active, B - BFD-tracked, P - permanent
```

Table 18 describes the significant fields shown in the display.

Table 18 show ip static route Descriptions

Field	Description
Codes	Indicates the protocol that derived the route. The status codes are defined in the output.

show key chain

To display authentication key information, use the **show key chain** command in EXEC mode.

show key chain [*name-of-chain*]

Syntax Description

name-of-chain	(Optional) Name of the key chain to display, as named in the **key chain** command.

Defaults

Information about all key chains is displayed.

Command Modes

EXEC

Command History

Release	Modification
11.1	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Examples

The following is sample output from the **show key chain** command:

```
Router# show key chain

Key-chain trees:
    key 1 -- text "chestnut"
        accept lifetime (always valid) - (always valid) [valid now]
        send lifetime (always valid) - (always valid) [valid now]
    key 2 -- text "birch"
        accept lifetime (00:00:00 Dec 5 1995) - (23:59:59 Dec 5 1995)
        send lifetime (06:00:00 Dec 5 1995) - (18:00:00 Dec 5 1995)
```

Related Commands

Command	Description
accept-lifetime	Sets the time period during which the authentication key on a key chain is received as valid.
key	Identifies an authentication key on a key chain.
key chain	Enables authentication for routing protocols.
key-string (authentication)	Specifies the authentication string for a key.
send-lifetime	Sets the time period during which an authentication key on a key chain is valid to be sent.

show monitor event-trace

To display event trace messages for Cisco IOS software subsystem components, use the **show monitor event-trace** command in privileged EXEC mode.

show monitor event-trace [**all-traces**] [*component* {**all** | **back** *hour:minute* | **clock** *hour:minute* | **from-boot** *seconds* | **latest** | **parameters**}]

Syntax Description

all-traces	(Optional) Displays all event trace messages in memory to the console.
component	(Optional) Name of the Cisco IOS software subsystem component that is the object of the event trace. To get a list of components that support event tracing in this release, use the **monitor event-trace ?** command.
all	Displays all event trace messages currently in memory for the specified component.
back *hour:minute*	Specifies how far back from the current time you want to view messages. For example, you can gather messages from the last 30 minutes. The time argument is specified in hours and minutes format (hh:mm).
clock *hour:minute*	Displays event trace messages starting from a specific clock time in hours and minutes format (hh:mm).
from-boot *seconds*	Displays event trace messages starting from a specified number of seconds after booting (uptime). To display the uptime, in seconds, enter the **show monitor event-trace** *component* **from-boot ?** command.
latest	Displays only the event trace messages since the last **show monitor event-trace** command was entered.
parameters	Displays the trace parameters. The only parameter displayed is the size (number of trace messages) of the trace file.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.0(18)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S. The **show monitor event-trace cef** comand replaced the **show cef events** and **show ip cef events** commands.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE. The **spa** component keyword was added to support online insertion and removal (OIR) event messages for shared port adapters (SPAs). The **bfd** keyword was added for the *component* argument to display trace messages relating to the Bidirectional Forwarding Detection (BFD) feature.
12.4(4)T	Support for the **bfd** keyword was added for Cisco IOS Release 12.4(4)T.
12.0(31)S	Support for the **bfd** keyword was added for Cisco IOS Release 12.0(31)S.

Release	Modification
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers.
12.4(9)T	The **cfd** keyword was added as an entry for the *component* argument to display trace messages relating to crypto fault detection.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.4(20)T	This command was integrated into Cisco IOS Release 12.4(20)T.

Usage Guidelines

Use the **show monitor event-trace** command to display trace message information.

The trace function is not locked while information is being displayed to the console, which means that new trace messages can accumulate in memory. If entries accumulate faster than they can be displayed, some messages can be lost. If this happens, the **show monitor event-trace** command will generate a message indicating that some messages might be lost; however, messages will continue to display on the console. If the number of lost messages is excessive, the **show monitor event-trace** command will stop displaying messages.

Use the **bfd** keyword for the *component* argument to display trace messages relating to the BFD feature.

Use the **cfd** keyword for the *component* argument to display trace messages relating to the crypto fault detection feature. This keyword displays the contents of the error trace buffers in an encryption data path.

Examples

IPC Component Example

The following is sample output from the **show monitor event-trace** *component* command for the interprocess communication (IPC) component. Notice that each trace message is numbered and is followed by a time stamp (derived from the device uptime). Following the time stamp is the component-specific message data.

```
Router# show monitor event-trace ipc

3667:  6840.016:Message type:3 Data=0123456789
3668:  6840.016:Message type:4 Data=0123456789
3669:  6841.016:Message type:5 Data=0123456789
3670:  6841.016:Message type:6 Data=0123456
```

BFD Component for Cisco IOS Release 12.2(18)SXE, 12.0(31)S, and 12.4(4)T

Use the **show monitor event-trace bfd all** command to display logged messages for important BFD events in the recent past. The following trace messages show BFD session state changes:

```
Router# show monitor event-trace bfd all

    3d03h: EVENT: Session [172.16.10.2,172.16.10.1,Fa6/0,1], event Session
           create, state Unknown -> Fail
    3d03h: EVENT: Session [172.16.10.2,172.16.10.1,Fa6/0,1], state Fail -> Down
            (from LC)
    3d03h: EVENT: Session [172.16.10.2,172.16.10.1,Fa6/0,1], state Down -> Init
            (from LC)
    3d03h: EVENT: Session [172.16.10.2,172.16.10.1,Fa6/0,1], state Init -> Up
           (from LC)
    3d07h: EVENT: Session [172.16.10.2,172.16.10.1,Fa6/0,2], event Session
```

```
       create, state Unknown -> Fail
3d07h: EVENT: Session [172.16.10.2,172.16.10.1,Fa6/0,2], state Fail -> Down
        (from LC)
3d07h: EVENT: Session [172.16.10.2,172.16.10.1,Fa6/0,2], state Down -> Up
       (from LC)
```

To display trace information for all components configured for event tracing on the networking device, enter the **show monitor event-trace all-traces** command. In this example, separate output is provided for each event, and message numbers are interleaved between the events.

```
Router# show monitor event-trace all-traces

Test1 event trace:
3667: 6840.016:Message type:3 Data=0123456789
3669: 6841.016:Message type:4 Data=0123456789
3671: 6842.016:Message type:5 Data=0123456789
3673: 6843.016:Message type:6 Data=0123456789

Test2 event trace:
3668: 6840.016:Message type:3 Data=0123456789
3670: 6841.016:Message type:4 Data=0123456789
3672: 6842.016:Message type:5 Data=0123456789
3674: 6843.016:Message type:6 Data=0123456789
```

SPA Component Example

The following is sample output from the **show monitor event-trace** *component* **latest** command for the **spa** component:

```
Router# show monitor event-trace spa latest

00:01:15.364: subslot 2/3: 4xOC3 POS SPA, TSM Event:inserted  New state:wait_psm
_ready
     spa type 0x440
00:02:02.308: subslot 2/0: not present, TSM Event:empty  New state:remove
     spa type 0x0, fail code 0x0(none)
00:02:02.308: subslot 2/0: not present, TSM Event:remove_complete  New state:idle
00:02:02.308: subslot 2/1: not present, TSM Event:empty  New state:remove
     spa type 0x0, fail code 0x0(none)
00:02:02.308: subslot 2/1: not present, TSM Event:remove_complete  New state:idle
00:02:02.308: subslot 2/2: not present, TSM Event:empty  New state:remove
     spa type 0x0, fail code 0x0(none)
00:02:02.308: subslot 2/2: not present, TSM Event:remove_complete  New state:idle
00:02:02.312: subslot 2/3: not present(plugin 4xOC3 POS SPA), TSM Event:empty  New
state:remove
     spa type 0x0, fail code 0x0(none)
00:02:02.312: subslot 2/3: not present, TSM Event:remove_complete  New state:idle
```

Cisco Express Forwarding Component Examples

If you select Cisco Express Forwarding as the component for which to display event messages, you can use the following additional arguments and keywords: **show monitor event-trace cef** [**events** | **interface** | **ipv6** | **ipv4**][**all**].

The following example shows the IPv6 or IPv4 events related to the Cisco Express Forwarding component. Each trace message is numbered and is followed by a time stamp (derived from the device uptime). Following the time stamp is the component-specific message data.

```
Router# show monitor event-trace cef ipv6 all

00:00:24.612:  [Default] *::*/*'00             New FIB table          [OK]

Router# show monitor event-trace cef ipv4 all
```

```
00:00:24.244:  [Default] 127.0.0.81/32'01       FIB insert              [OK]
```

In the following example, all event trace messages for the Cisco Express Forwarding component are displayed:

```
Router# show monitor event-trace cef events all

00:00:18.884: SubSys  fib_ios_chain init
00:00:18.884: Inst    unknown -> RP
00:00:24.584: SubSys  fib init
00:00:24.592: SubSys  fib_ios init
00:00:24.592: SubSys  fib_ios_if init
00:00:24.596: SubSys  ipv4fib init
00:00:24.608: SubSys  ipv4fib_ios init
00:00:24.612: SubSys  ipv6fib_ios init
00:00:24.620: Flag    IPv4 CEF enabled set to yes
00:00:24.620: Flag    0x7BF6B62C set to yes
00:00:24.620: Flag    IPv4 CEF switching enabled set to yes
00:00:24.624: GState  CEF enabled
00:00:24.628: SubSys  ipv4fib_les init
00:00:24.628: SubSys  ipv4fib_pas init
00:00:24.632: SubSys  ipv4fib_util init
00:00:25.304: Process Background created
00:00:25.304: Flag    IPv4 CEF running set to yes
00:00:25.304: Process Background event loop enter
00:00:25.308: Flag    IPv4 CEF switching running set to yes
```

The following example shows Cisco Express Forwarding interface events:

```
Router# show monitor event-trace cef interface all

00:00:24.624: <empty>      (sw  4) Create   new
00:00:24.624: <empty>      (sw  4) SWIDBLnk FastEthernet0/0(4)
00:00:24.624: Fa0/0        (sw  4) NameSet
00:00:24.624: <empty>      (hw  1) Create   new
00:00:24.624: <empty>      (hw  1) HWIDBLnk FastEthernet0/0(1)
00:00:24.624: Fa0/0        (hw  1) NameSet
00:00:24.624: <empty>      (sw  3) Create   new
00:00:24.624: <empty>      (sw  3) SWIDBLnk FastEthernet0/1(3)
00:00:24.624: Fa0/1        (sw  3) NameSet
00:00:24.624: <empty>      (hw  2) Create   new
```

Cisco Express Forwarding Component Examples for Cisco 10000 Series Routers Only

The following example shows the IPv4 events related to the Cisco Express Forwarding component. Each trace message is numbered and is followed by a time stamp (derived from the device uptime). Following the time stamp is the component-specific message data.

```
Router# show monitor event-trace cef ipv4 all

00:00:48.244:  [Default] 127.0.0.81/32'01      FIB insert               [OK]
```

In the following example, all event trace message for the Cisco Express Forwarding component are displayed:

```
Router# show monitor event-trace cef events all

00:00:18.884: SubSys  fib_ios_chain init
00:00:18.884: Inst    unknown -> RP
00:00:24.584: SubSys  fib init
00:00:24.592: SubSys  fib_ios init
00:00:24.592: SubSys  fib_ios_if init
00:00:24.596: SubSys  ipv4fib init
00:00:24.608: SubSys  ipv4fib_ios init
```

```
00:00:24.620: Flag    IPv4 CEF enabled set to yes
00:00:24.620: Flag    0x7BF6B62C set to yes
00:00:24.620: Flag    IPv4 CEF switching enabled set to yes
00:00:24.624: GState  CEF enabled
00:00:24.628: SubSys  ipv4fib_les init
00:00:24.628: SubSys  ipv4fib_pas init
00:00:24.632: SubSys  ipv4fib_util init
00:00:25.304: Process Background created
00:00:25.304: Flag    IPv4 CEF running set to yes
00:00:25.304: Process Background event loop enter
00:00:25.308: Flag    IPv4 CEF switching running set to yes
```

The following examples show Cisco Express Forwarding interface events:

```
Router# show monitor event-trace cef interface all

00:00:24.624: <empty>      (sw  4) Create   new
00:00:24.624: <empty>      (sw  4) SWIDBLnk FastEthernet1/0/0(4)
00:00:24.624: Fa0/0        (sw  4) NameSet
00:00:24.624: <empty>      (hw  1) Create   new
00:00:24.624: <empty>      (hw  1) HWIDBLnk FastEthernet1/0/0(1)
00:00:24.624: Fa0/0        (hw  1) NameSet
00:00:24.624: <empty>      (sw  3) Create   new
00:00:24.624: <empty>      (sw  3) SWIDBLnk FastEthernet1/1/0(3)
00:00:24.624: Fa0/1        (sw  3) NameSet
00:00:24.624: <empty>      (hw  2) Create   new
```

CFD Component for Cisco IOS Release 12.4(9)T

To troubleshoot errors in an encryption datapath, enter the **show monitor event-trace cfd all** command. In this example, events are shown separately, each beginning with a time stamp, followed by data from the error trace buffer. Cisco Technical Assistence Center (TAC) engineers can use this information to diagnose the cause of the errors.

Note If no packets have been dropped, this command does not display any output.

```
Router# show monitor event-trace cfd all

00:00:42.452: 450000B4 00060000 FF33B306 02020203 02020204 32040000 F672999C
        00000001 7A7690C2 A0A4F8BC E732985C D6FFDCC8 00000001 C0902BD0
        A99127AE 8EAA22D4

00:00:44.452: 450000B4 00070000 FF33B305 02020203 02020204 32040000 F672999C
        00000002 93C01218 2325B697 3C384CF1 D6FFDCC8 00000002 BFA13E8A
        D21053ED 0F62AB0E

00:00:46.452: 450000B4 00080000 FF33B304 02020203 02020204 32040000 F672999C
        00000003 7D2E11B7 A0BA4110 CC62F91E D6FFDCC8 00000003 7236B930
        3240CA8C 9EBB44FF

00:00:48.452: 450000B4 00090000 FF33B303 02020203 02020204 32040000 F672999C
        00000004 FB6C80D9 1AADF938 CDE57ABA D6FFDCC8 00000004 E10D8028
        6BBD748F 87F5E253

00:00:50.452: 450000B4 000A0000 FF33B302 02020203 02020204 32040000 F672999C
        00000005 697C8D9D 35A8799A 2A67E97B D6FFDCC8 00000005 BC21669D
        98B29FFF F32670F6

00:00:52.452: 450000B4 000B0000 FF33B301 02020203 02020204 32040000 F672999C
```

```
00000006 CA18CBC4 0F387FE0 9095C27C D6FFDCC8 00000006 87A54811
AE3A0517 F8AC4E64
```

Related Commands

Command	Description
monitor event-trace (EXEC)	Controls event trace functions for a specified Cisco IOS software subsystem component.
monitor event-trace (global)	Configures event tracing for a specified Cisco IOS software subsystem component.
monitor event-trace dump-traces	Saves trace messages for all event traces currently enabled on the networking device.

show route-map

To display static and dynamic route maps, use the **show route-map** command in privileged EXEC mode.

show route-map [*map-name* | **dynamic** [*dynamic-map-name* | **application** [*application-name*]] | **all**] [**detailed**]

Syntax Description

map-name	(Optional) Name of a specific route map.
dynamic	(Optional) Displays dynamic route map information.
dynamic-map-name	(Optional) Name of a specific dynamic route map.
application	(Optional) Displays dynamic route maps based on applications.
application-name	(Optional) Name of a specific application.
all	(Optional) Displays all static and dynamic route maps.
detailed	(Optional) Displays the details of the access control lists (ACLs) that have been used in the **match** clauses for dynamic route maps.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
10.0	This command was introduced.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S, and support for continue clauses was integrated into the command output.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(27)SBA	The output was enhanced to display dynamically assigned route maps to VRF tables.
12.2(15)T	An additional counter collect policy routing statistic was integrated into Cisco IOS Release 12.2(15)T.
12.3(2)T	Support for continue clauses was integrated into Cisco IOS Release 12.3(2)T.
12.2(17b)SXA	This command was integrated into Cisco IOS Release 12.2(17b)SXA.
12.3(7)T	The **dynamic**, **application**, and **all** keywords were added.
12.0(28)S	The support for recursive **next-hop** clause was added.
12.3(14)T	The support for recursive **next-hop** clause was integrated into Cisco IOS Release 12.3(14)T. Support for the map display extension functionality was added. The **detailed** keyword was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
Cisco IOS XE Release 2.2	In Cisco IOS XE Release 2.2 this command was introduced on the Cisco ASR 1000 Series Routers.
15.0(1)M	This command was modified. The **detailed** keyword was removed.

Usage Guidelines

You can view static and dynamic route maps with the **show route-map** command. For Cisco IOS Release 12.3(14)T and later 12.4 and 12.4T releases, you can display the ACL-specific information that pertains to the route map in the same display without having to execute a **show route-map** command to display each ACL that is associated with the route map.

Redistribution

Use the **route-map** global configuration command, and the **match** and **set** route-map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the match criteria—the conditions under which redistribution is allowed for the current route-map command. The **set** commands specify the set actions—the particular redistribution actions to perform if the criteria enforced by the match commands are met. The **no route-map** command deletes the route map.

The **match route-map** configuration command has multiple formats. The **match** commands can be given in any order, and all match commands must "pass" to cause the route to be redistributed according to the set actions given with the set commands. The **no** forms of the **match** commands remove the specified match criteria.

Use **route maps** when you want detailed control over how routes are redistributed between routing processes. The destination routing protocol is the one you specify with the router global configuration command. The source routing protocol is the one you specify with the **redistribute** router configuration command. See the "Examples" section for an illustration of how route maps are configured.

When you are passing routes through a route map, a route map can have several parts. Any route that does not match at least one match clause relating to a **route-map** command will be ignored; that is, the route will not be advertised for outbound route maps and will not be accepted for inbound route maps. If you want to modify only some data, you must configure a second route map section with an explicit match specified.

Examples

The **show route-map** command will display configured route-maps, match, set, and continue clauses. The output will vary depending on which keywords are included with the command, and which software image is running in your router, as shown in the following examples:

- show route-map Command with No Keywords Specified: Example, page 177
- show route-map Command with Dynamic Route Map Specified: Example, page 179
- show route-map Command with Detailed ACL Information for Route Maps Specified: Example, page 180
- show route-map Command with VRF Autoclassification: Example, page 180

show route-map Command with No Keywords Specified: Example

The following is sample output from the **show route-map** command:

```
Router# show route-map

route-map ROUTE-MAP-NAME, permit, sequence 10
  Match clauses:
    ip address (access-lists): 1
    metric 10
  Continue: sequence 40
  Set clauses:
    as-path prepend 10
  Policy routing matches: 0 packets, 0 bytes
route-map ROUTE-MAP-NAME, permit, sequence 20
```

```
  Match clauses:
    ip address (access-lists): 2
    metric 20
  Set clauses:
    as-path prepend 10 10
  Policy routing matches: 0 packets, 0 bytes
route-map ROUTE-MAP-NAME, permit, sequence 30
  Match clauses:
  Continue: to next entry 40
  Set clauses:
    as-path prepend 10 10 10
  Policy routing matches: 0 packets, 0 bytes
route-map ROUTE-MAP-NAME, deny, sequence 40
  Match clauses:
    community (community-list filter): 20:2
  Set clauses:
    local-preference 100
  Policy routing matches: 0 packets, 0 bytes
route-map LOCAL-POLICY-MAP, permit, sequence 10
  Match clauses:
  Set clauses:
    community 655370
  Policy routing matches: 0 packets, 0 bytes
```

The following example shows Multiprotocol Label Switching (MPLS)-related route map information:

```
Router# show route-map

route-map OUT, permit, sequence 10
Match clauses:
  ip address (access-lists): 1
Set clauses:
  mpls label
Policy routing matches: 0 packets, 0 bytes

route-map IN, permit, sequence 10
Match clauses:
  ip address (access-lists): 2
  mpls label
Set clauses:
Policy routing matches: 0 packets, 0 bytes
```

Table 19 describes the significant fields shown in the display.

Table 19 show route-map Field Descriptions

Field	Description
route-map ROUTE-MAP-NAME	Name of the route map.
permit	Indicates that the route is redistributed as controlled by the set actions.
sequence	Number that indicates the position a new route map is to have in the list of route maps already configured with the same name.
Match clauses: tag	Match criteria—Conditions under which redistribution is allowed for the current route map.
Continue:	Continue clause—Shows the configuration of a continue clause and the route-map entry sequence number that the continue clause will go to.

Table 19 show route-map Field Descriptions (continued)

Field	Description
Set clauses: metric	Set actions—The particular redistribution actions to perform if the criteria enforced by the **match** commands are met.
Policy routing matches:	Number of packets and bytes that have been filtered by policy routing.

show route-map Command with Dynamic Route Map Specified: Example

The following is sample output from the **show route-map** command when entered with the **dynamic** keyword:

```
Router# show route-map dynamic

route-map AAA-02/06/04-14:01:26.619-1-AppSpec, permit, sequence 0, identifier 1137954548
  Match clauses:
    ip address (access-lists): PBR#1 PBR#2
  Set clauses:
  Policy routing matches: 0 packets, 0 bytes
route-map AAA-02/06/04-14:01:26.619-1-AppSpec, permit, sequence 1, identifier 1137956424
  Match clauses:
    ip address (access-lists): PBR#3 PBR#4
  Set clauses:
  Policy routing matches: 0 packets, 0 bytes
route-map AAA-02/06/04-14:01:26.619-1-AppSpec, permit, sequence 2, identifier 1124436704
  Match clauses:
    ip address (access-lists): PBR#5 PBR#6
    length 10 100
  Set clauses:
    ip next-hop 172.16.1.1
    ip gateway 172.16.1.1
  Policy routing matches: 0 packets, 0 bytes
Current active dynamic routemaps = 1
```

The following is sample output from the **show route-map** command when entered with the **dynamic** and **application** keywords:

```
Router# show route-map dynamic application

Application - AAA
  Number of active routemaps = 1
```

When you specify an application name, only dynamic routes for that application are shown. The following is sample output from the **show route-map** command when entered with the **dynamic** and **application** keywords and the AAA application name:

```
Router# show route-map dynamic application AAA

AAA
  Number of active rmaps = 2
AAA-02/06/04-14:01:26.619-1-AppSpec
AAA-02/06/04-14:34:09.735-2-AppSpec

Router# show route-map dynamic AAA-02/06/04-14:34:09.735-2-AppSpec

route-map AAA-02/06/04-14:34:09.735-2-AppSpec, permit, sequence 0, identifier 1128046100
  Match clauses:
    ip address (access-lists): PBR#7 PBR#8
  Set clauses:
  Policy routing matches: 0 packets, 0 bytes
```

```
route-map AAA-02/06/04-14:34:09.735-2-AppSpec, permit, sequence 1, identifier 1141277624
  Match clauses:
    ip address (access-lists): PBR#9 PBR#10
  Set clauses:
  Policy routing matches: 0 packets, 0 bytes
route-map AAA-02/06/04-14:34:09.735-2-AppSpec, permit, sequence 2, identifier 1141279420
  Match clauses:
    ip address (access-lists): PBR#11 PBR#12
    length 10 100
  Set clauses:
    ip next-hop 172.16.1.12
    ip gateway 172.16.1.12
  Policy routing matches: 0 packets, 0 bytes
Current active dynamic routemaps = 2
```

show route-map Command with Detailed ACL Information for Route Maps Specified: Example

The following is sample output from the **show route-map** command with the **dynamic** and **detailed** keywords entered:

```
Router# show route-map dynamic detailed

route-map AAA-01/20/04-22:03:10.799-1-AppSpec, permit, sequence 1, identifier 29675368
Match clauses:
ip address (access-lists):
Extended IP access list PBR#3
1 permit icmp 0.0.16.12 1.204.167.240 10.1.1.0 0.0.0.255 syn dscp af12 log-input fragments
Extended IP access list PBR#4
1 permit icmp 0.0.16.12 1.204.167.240 10.1.1.0 0.0.0.255 syn dscp af12 log-input fragments
Set clauses:
ip next-hop 172.16.1.14
ip gateway 172.16.1.14
Policy routing matches: 0 packets, 0 bytes
```

show route-map Command with VRF Autoclassification: Example

The following is sample output from the **show route-map** command when a specified VRF is configured for VRF autoclassification:

```
Router# show route-map dynamic

route-map None-06/01/04-21:14:21.407-1-IP VRF, permit, sequence 0
identifier 1675771000
 Match clauses:
 Set clauses: vrf red
 Policy routing matches: 0 packets, 0 bytes
Current active dynamic routemaps = 1
```

Related Commands

Command	Description
redistribute (IP)	Redistributes routes from one routing domain into another routing domain.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
match interface (IP)	Distributes any routes that have their next hop out one of the interfaces specified.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match tag	Redistributes routes in the routing table that match the specified tags.

traffic-share min

To configure traffic to use minimum-cost routes, when there are multiple routes that have different-cost routes to the same destination network, use the **traffic-share min** command in router address family topology or router configuration mode. To disable this function, use the **no** form of this command.

traffic-share min across-interfaces

no traffic-share min across-interfaces

Syntax Description

across-interfaces	Configures multi-interface load splitting on several interfaces with equal-cost paths.

Defaults

Traffic is configured to use minimum-cost paths.

Command Modes

Router address family topology configuration (config-router-af-topology)
Router configuration (config-router)

Command History

Release	Modification
10.0	This command was introduced.
11.0(3)	This command became protocol independent when the **across-interfaces** keyword was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was made available in router address family topology configuration mode.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines

The **traffic-share min** command causes the Cisco IOS software to divide traffic only among the routes with the best metric. Other routes will remain in the routing table, but will receive no traffic. Configuring this command with the **across-interfaces** keyword allows you to configure multi-interface load splitting on different interfaces with equal-cost paths.

Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **traffic-share min** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

Examples

In the following example, multi-interface load splitting is configured on different interfaces with equal-cost paths:

```
router ospf 5
 traffic-share min across-interfaces
```

vccv

To configure the pseudowire Virtual Circuit Connection Verification (VCCV) control channel (CC) type for Multiprotocol Label Switching (MPLS) pseudowires, use the **vccv** command in pseudowire class configuration mode. To disable a pseudowire VCCV CC type, use the **no** form of this command.

vccv {**control-word | router-alert | ttl**}

no vccv {**control-word | router-alert | ttl** }

Syntax Description

control-word	Specifies the control channel (CC) Type 1: control word.
router-alert	Specifies the CC Type 2: MPLS router alert label.
ttl	Specifies the CC Type 3: MPLS pseudowire label with Time to Live (TTL).

Command Default

The pseudowire VCCV CC type is set to Type 1 (control word).

Command Modes

Pseudowire-class configuration (config-pw-class)

Command History

Release	Modification
15.0(1)S	This command was introduced.

Usage Guidelines

When an initiating provider edge (PE) device sends a setup request message to a remote PE device, the message includes VCCV capability information. This capability information is a combination of the CC type and the control verification (CV) type. You use the **vccv** command to configure the CC type capabilities of the MPLS pseudowire.

If the CV type for the MPLS pseudowire is set to a type that does not use IP/User Datagram Protocol (UDP) headers, then you must set the CC type to the CC Type 1: control word.

Examples

The following example shows how to configure the MPLS pseudowire class to use CC Type 1:

```
Router(config)# pseudowire-class bfdclass
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# protocol none
Router(config-pw-class)# vccv control-word
```

Related Commands

Command	Description
bfd-template	Creates a BFD template and enters BFD configuration mode.
pseudowire-class	Specifies the name of the pseudowire class and enters pseudowire class configuration mode.

Command	Description
vccv bfd template	Enables VCCV BFD for a pseudowire class.
vccv bfd status signaling	Enables status signaling for BFD VCCV.

vccv bfd status signaling

To enable status signaling for Bidirectional Forwarding Detection (BFD) Virtual Circuit Connection Verification (VCCV), use the **vccv bfd status signaling** command in pseudowire class configuration mode. To disable status signaling, use the **no** form of this command.

vccv bfd status signaling

no vccv bfd status signaling

Syntax Description

This command has no arguments or keywords.

Command Default

VCCV BFD status signaling is disabled.

Command Modes

Pseudowire-class configuration (config-pw-class)

Command History

Release	Modification
15.0(1)S	This command was introduced.

Usage Guidelines

Use this command to allow BFD to provide status signaling functionality that indicates the fault status of an attachment circuit (AC).

Examples

The following example shows how to enable VCCV BFD status signaling for a Multiprotocol Label Switching (MPLS) pseudowire class:

```
Router(config)# pseudowire-class bfdclass
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# protocol none
Router(config-pw-class)# vccv control-word
Router(config-pw-class)# vccv bfd template bfdtemplate raw-bfd
Router(config-pw-class)# vccv bfd status signaling
```

Related Commands

Command	Description
bfd-template	Creates a BFD template and enters BFD configuration mode.
pseudowire-class	Specifies the name of the pseudowire class and enters pseudowire class configuration mode.
vccv	Configures the pseudowire VCCV CC type for MPLS pseudowires.
vccv bfd template	Enables VCCV BFD for a pseudowire class.

vccv bfd template

To enable Virtual Circuit Connection Verification (VCCV) Bidirectional Forwarding Detection (BFD) for a pseudowire class, use the **vccv bfd template** command in pseudowire class configuration mode. To disable VCCV BFD, use the **no** form of this command.

vccv bfd template *name* [**udp** | **raw-bfd**]

no vccv bfd template *name* [**udp** | **raw-bfd**]

Syntax Description

name	The name of the BFD template to use.
udp	(Optional) Enables support for BFD with IP/User Datagram Protocol (UDP) header encapsulation.
raw-bfd	(Optional) Enables support for BFD without IP/UDP header encapsulation.

Command Default

VCCV BFD is not enabled for the pseudowire class.

Command Modes

Pseudowire-class configuration (config-pw-class)

Command History

Release	Modification
15.0(1)S	This command was introduced.

Usage Guidelines

The BFD template specified by the *name* argument is created using the **bfd-template** command, and contains settings for the BFD interval values.

VCCV defines two types encapsulation for VCCV messages to differentiate them from data packets: BFD with IP/UDP headers and BFD without IP/UDP headers.

Support for BFD without IP/UDP headers can be enabled only for pseudowires that use a control word, or a Layer 2 Specific Sublayer (L2SS) that can take the pseudowire associated Channel Header Control Word format.

If the VCCV carries raw BFD, the control word or the L2SS Channel Type must be set to BFD without IP/UDP headers. BFD without IP/UDP headers allows the system to identify the BFD packet when demultiplexing the control channel.

Examples

The following example shows how to enable the BFD template without support for IP/UDP header encapsulation:

```
Router(config)# pseudowire-class bfdclass
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# protocol none
Router(config-pw-class)# vccv control-word
Router(config-pw-class)# vccv bfd template bfdtemplate raw-bfd
Router(config-pw-class)# vccv bfd status signaling
```