



# Implementing EIGRP

The Enhanced Interior Gateway Routing Protocol (EIGRP) is an enhanced version of IGRP developed by Cisco. This module describes the concepts and tasks you need to implement basic EIGRP configuration using Cisco IOS XR software. EIGRP uses distance vector routing technology, which specifies that a router need not know all the router and link relationships for the entire network. Each router advertises destinations with a corresponding distance and upon receiving routes, adjusts the distance and propagates the information to neighboring routes.



**Note** For more information about EIGRP on the Cisco IOS XR software and complete descriptions of the EIGRP commands listed in this module, see the *EIGRP Commands* chapter in the *Routing Command Reference for Cisco NCS 6000 Series Routers*. To locate documentation for other commands that might appear while executing a configuration task, search online in the Cisco IOS XR software master command index.

## Feature History for Implementing EIGRP

Release 5.0.0	This feature was introduced.
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## Prerequisites for Implementing EIGRP

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

## Restrictions for Implementing EIGRP

The following restrictions are employed when running EIGRP on this version of Cisco IOS XR software:

- 
- The characters allowed for EIGRP process name are @ . # : - \_ only.
- Simple Network Management Protocol (SNMP) MIB is not supported.
- Interface static routes are not automatically redistributed into EIGRP, because there are no network commands.
- Metric configuration (either through the **default-metric** command or a route policy) is required for redistribution of connected and static routes.
- Auto summary is disabled by default.
- Stub leak maps are not supported.

## Information About Implementing EIGRP

To implement EIGRP, you need to understand the following concepts:

### EIGRP Functional Overview

Enhanced Interior Gateway Routing Protocol (EIGRP) is an interior gateway protocol suited for many different topologies and media. EIGRP scales well and provides extremely quick convergence times with minimal network traffic.

EIGRP has very low usage of network resources during normal operation. Only hello packets are transmitted on a stable network. When a change in topology occurs, only the routing table changes are propagated and not the entire routing table. Propagation reduces the amount of load the routing protocol itself places on the network. EIGRP also provides rapid convergence times for changes in the network topology.

The distance information in EIGRP is represented as a composite of available bandwidth, delay, load utilization, and link reliability with improved convergence properties and operating efficiency. The fine-tuning of link characteristics achieves optimal paths.

The convergence technology that EIGRP uses is based on research conducted at SRI International and employs an algorithm referred to as the Diffusing Update Algorithm (DUAL). This algorithm guarantees loop-free operation at every instant throughout a route computation and allows all devices involved in a topology change to synchronize at the same time. Routers that are not affected by topology changes are not involved in recomputations. The convergence time with DUAL rivals that of any other existing routing protocol.

### EIGRP Features

EIGRP offers the following features:

- Fast convergence—The DUAL algorithm allows routing information to converge as quickly as any currently available routing protocol.

- Partial updates—EIGRP sends incremental updates when the state of a destination changes, instead of sending the entire contents of the routing table. This feature minimizes the bandwidth required for EIGRP packets.
- Neighbor discovery mechanism—This is a simple hello mechanism used to learn about neighboring routers. It is protocol independent.
- Variable-length subnet masks (VLSMs).
- Arbitrary route summarization.
- Scaling—EIGRP scales to large networks.
- Support for IPv4 and IPv6 address families.
- Provider Edge (PE)-Customer Edge (CE) protocol support with Site of Origin (SoO) and Border Gateway Protocol (BGP) cost community support.

## EIGRP Components

EIGRP has the following four basic components:

- Neighbor discovery or neighbor recovery
- Reliable transport protocol
- DUAL finite state machine
- Protocol-dependent modules

Neighbor discovery or neighbor recovery is the process that routers use to dynamically learn of other routers on their directly attached networks. Routers must also discover when their neighbors become unreachable or inoperative. Neighbor discovery or neighbor recovery is achieved with low overhead by periodically sending small hello packets. As long as hello packets are received, the Cisco IOS XR software can determine that a neighbor is alive and functioning. After this status is determined, the neighboring routers can exchange routing information.

The reliable transport protocol is responsible for guaranteed, ordered delivery of EIGRP packets to all neighbors. Some EIGRP packets must be sent reliably and others need not be. For efficiency, reliability is provided only when necessary.

The DUAL finite state machine embodies the decision process for all route computations. It tracks all routes advertised by all neighbors. DUAL uses the distance information (known as a metric) to select efficient, loop-free paths. DUAL selects routes to be inserted into a routing table based on a calculation of the feasibility condition. A successor is a neighboring router used for packet forwarding that has a least-cost path to a destination that is guaranteed not to be part of a routing loop. When there are no feasible successors but there are neighbors advertising the destination, a recomputation must occur. This is the process whereby a new successor is determined. The amount of time required to recompute the route affects the convergence time. Recomputation is processor intensive; it is advantageous to avoid unneeded recomputation. When a topology change occurs, DUAL tests for feasible successors. If there are feasible successors, it uses any it finds to avoid unnecessary recomputation.

The protocol-dependent modules are responsible for network layer protocol-specific tasks. An example is the EIGRP module, which is responsible for sending and receiving EIGRP packets that are encapsulated in IP. It is also responsible for parsing EIGRP packets and informing DUAL of the new information received. EIGRP

asks DUAL to make routing decisions, but the results are stored in the IP routing table. EIGRP is also responsible for redistributing routes learned by other IP routing protocols.

## EIGRP Configuration Grouping

Cisco IOS XR software groups all EIGRP configuration under router EIGRP configuration mode, including interface configuration portions associated with EIGRP. To display EIGRP configuration in its entirety, use the **show running-config router eigrp** command. The command output displays the running configuration for the configured EIGRP instance, including the interface assignments and interface attributes.

## EIGRP Configuration Modes

The following examples show how to enter each of the configuration modes. From a mode, you can enter the ? command to display the commands available in that mode.

### Router Configuration Mode

The following example shows how to enter router configuration mode:

### IPv4 Address Family Configuration Mode

The following example shows how to enter IPv4 address family configuration mode:

```
RP/0/RP0/CPU0:router# configuration
RP/0/RP0/CPU0:router(config)# router eigrp 100
RP/0/RP0/CPU0:router(config-eigrp)# address-family ipv4
RP/0/RP0/CPU0:router(config-eigrp-af)#
```

### Interface Configuration Mode

The following example shows how to enter interface configuration mode in IPv4 address family configuration mode:

```
RP/0/RP0/CPU0:router# configuration
RP/0/RP0/CPU0:router(config)# router eigrp 100
RP/0/RP0/CPU0:router(config-eigrp)# address-family ipv4
RP/0/RP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/3/0/0
RP/0/RP0/CPU0:router(config-eigrp-af-if)#
```

## EIGRP Interfaces

EIGRP interfaces can be configured as either of the following types:

- **Active**—Advertises connected prefixes and forms adjacencies. This is the default type for interfaces.
- **Passive**—Advertises connected prefixes but does not form adjacencies. The **passive** command is used to configure interfaces as passive. Passive interfaces should be used sparingly for important prefixes, such as loopback addresses, that need to be injected into the EIGRP domain. If many connected prefixes need to be advertised, then the redistribution of connected routes with the appropriate policy should be used instead.

## Redistribution for an EIGRP Process

Routes from other protocols can be redistributed into EIGRP. A route policy can be configured along with the **redistribute** command. A metric is required, configured either through the **default-metric** command or under the route policy configured with the **redistribute** command to import routes into EIGRP.

A route policy allows the filtering of routes based on attributes such as the destination, origination protocol, route type, route tag, and so on.

## Metric Weights for EIGRP Routing

EIGRP uses the minimum bandwidth on the path to a destination network and the total delay to compute routing metrics. You can use the **metric weights** command to adjust the default behavior of EIGRP routing and metric computations. For example, this adjustment allows you to tune system behavior to allow for satellite transmission. EIGRP metric defaults have been carefully selected to provide optimal performance in most networks.

By default, the EIGRP composite metric is a 32-bit quantity that is a sum of the segment delays and lowest segment bandwidth (scaled and inverted) for a given route. For a network of homogeneous media, this metric reduces to a hop count. For a network of mixed media (FDDI, Ethernet, and serial lines running from 9600 bits per second to T1 rates), the route with the lowest metric reflects the most desirable path to a destination.

## Mismatched K Values

Mismatched K values (EIGRP metrics) can prevent neighbor relationships from being established and can negatively impact network convergence. The following example explains this behavior between two EIGRP peers (ROUTER-A and ROUTER-B).

The following error message is displayed in the console of ROUTER-B because the K values are mismatched:

```
RP/0//CPU0:Mar 13 08:19:55:eigrp[163]:%ROUTING-EIGRP-5-NBRCHANGE:IP-EIGRP(0) 1:Neighbor
11.0.0.20 (GigabitEthernet0/6/0/0) is down: K-value mismatch
```

Two scenarios occur in which this error message can be displayed:

- The two routers are connected on the same link and configured to establish a neighbor relationship. However, each router is configured with different K values.

The following configuration is applied to ROUTER-A. The K values are changed with the **metric weights** command. A value of 2 is entered for the *k1* argument to adjust the bandwidth calculation. The value of 1 is entered for the *k3* argument to adjust the delay calculation.

```
hostname ROUTER-A!
interface GigabitEthernet0/6/0/0
  ipv4 address 10.1.1.1 255.255.255.0

router eigrp 100
  metric weights 0 2 0 1 0 0
  interface GigabitEthernet0/6/0/0
```

The following configuration is applied to ROUTER-B. However, the **metric weights** command is not applied and the default K values are used. The default K values are 1, 0, 1, 0, and 0.

```
hostname ROUTER-B!
interface GigabitEthernet0/6/0/1
  ipv4 address 10.1.1.2 255.255.255.0
```

```
router eigrp 100
 interface GigabitEthernet0/6/0/1
```

The bandwidth calculation is set to 2 on ROUTER-A and set to 1 (by default) on ROUTER-B. This configuration prevents these peers from forming a neighbor relationship.

- The K-value mismatch error message can also be displayed if one of the two peers has transmitted a “goodbye” message and the receiving router does not support this message. In this case, the receiving router interprets this message as a K-value mismatch.

## Goodbye Message

The goodbye message is a feature designed to improve EIGRP network convergence. The goodbye message is broadcast when an EIGRP routing process is shut down to inform adjacent peers about the impending topology change. This feature allows supporting EIGRP peers to synchronize and recalculate neighbor relationships more efficiently than would occur if the peers discovered the topology change after the hold timer expired.

The following message is displayed by routers that run a supported release when a goodbye message is received:

```
RP/0//CPU0:Mar 13 09:13:17:eigrp[163]:%ROUTING-EIGRP-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor
10.0.0.20 (GigabitEthernet0/6/0/0) is down: Interface Goodbye received
```

A Cisco router that runs a software release that does not support the goodbye message can misinterpret the message as a K-value mismatch and display the following message:

```
RP/0//CPU0:Mar 13 09:13:17:eigrp[163]:%ROUTING-EIGRP-5-NBRCHANGE: IP-EIGRP(0) 1: Neighbor
10.0.0.20 (GigabitEthernet0/6/0/0) is down: K-value mismatch
```



### Note

The receipt of a goodbye message by a nonsupporting peer does not disrupt normal network operation. The nonsupporting peer terminates the session when the hold timer expires. The sending and receiving routers reconverge normally after the sender reloads.

## Percentage of Link Bandwidth Used for EIGRP Packets

By default, EIGRP packets consume a maximum of 50 percent of the link bandwidth, as configured with the **bandwidth** interface configuration command. You might want to change that value if a different level of link utilization is required or if the configured bandwidth does not match the actual link bandwidth (it may have been configured to influence route metric calculations).

## Floating Summary Routes for an EIGRP Process

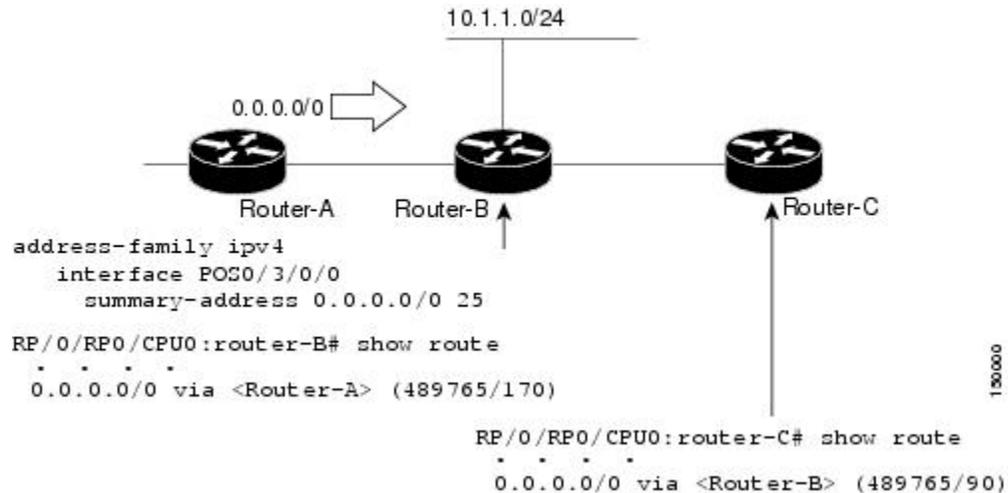
You can also use a floating summary route when configuring the **summary-address** command. The floating summary route is created by applying a default route and administrative distance at the interface level. The following scenario illustrates the behavior of this enhancement.

**Figure 1: Floating Summary Route Is Applied to Router-B, on page 7** shows a network with three routers, Router-A, Router-B, and Router-C. Router-A learns a default route from elsewhere in the network and then

advertises this route to Router-B. Router-B is configured so that only a default summary route is advertised to Router-C. The default summary route is applied to interface 0/1 on Router-B with the following configuration:

```
RP/0/RP0/CPU0:router(config)# router eigrp 100
RP/0/RP0/CPU0:router(config-eigrp)# address-family ipv4
RP/0/RP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/3/0/0
RP/0/RP0/CPU0:router(config-eigrp-af-if)# summary-address 100.0.0.0 0.0.0.0
```

**Figure 1: Floating Summary Route Is Applied to Router-B**



The configuration of the default summary route on Router-B sends a 0.0.0.0/0 summary route to Router-C and blocks all other routes, including the 10.1.1.0/24 route, from being advertised to Router-C. However, this configuration also generates a local discard route on Router-B, a route for 0.0.0.0/0 to the null 0 interface with an administrative distance of 5. When this route is created, it overrides the EIGRP learned default route. Router-B is no longer able to reach destinations that it would normally reach through the 0.0.0.0/0 route.

This problem is resolved by applying a floating summary route to the interface on Router-B that connects to Router-C. The floating summary route is applied by relating an administrative distance to the default summary route on the interface of Router-B with the following statement:

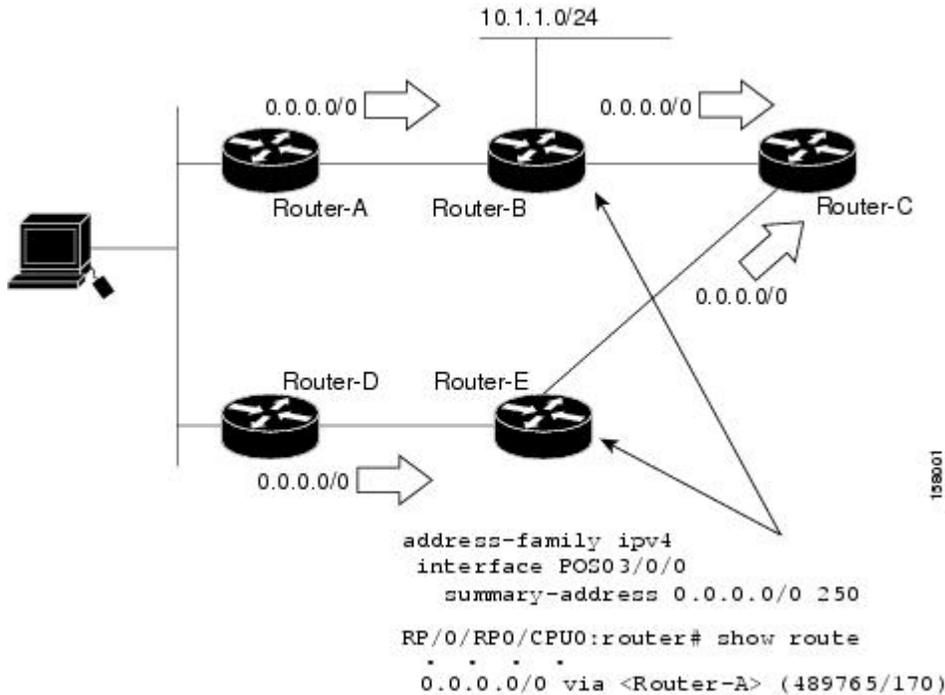
```
RP/0/RP0/CPU0:router(config-if)# summary-address 100 0.0.0.0 0.0.0.0 250
```

The administrative distance of 250, applied in the above statement, is now assigned to the discard route generated on Router-B. The 0.0.0.0/0, from Router-A, is learned through EIGRP and installed in the local routing table. Routing to Router-C is restored.

If Router-A loses the connection to Router-B, Router-B continues to advertise a default route to Router-C, which allows traffic to continue to reach destinations attached to Router-B. However, traffic destined for networks to Router-A or behind Router-A is dropped when the traffic reaches Router-B.

[Figure 2: Floating Summary Route Applied for Dual-Homed Remotes, on page 8](#) shows a network with two connections from the core: Router-A and Router-D. Both routers have floating summary routes configured on the interfaces connected to Router-C. If the connection between Router-E and Router-C fails, the network continues to operate normally. All traffic flows from Router-C through Router-B to the hosts attached to Router-A and Router-D.

Figure 2: Floating Summary Route Applied for Dual-Homed Remotes



However, if the link between Router-D and Router-E fails, the network may dump traffic into a black hole because Router-E continues to advertise the default route (0.0.0.0/0) to Router-C, as long as at least one link (other than the link to Router-C) to Router-E is still active. In this scenario, Router-C still forwards traffic to Router-E, but Router-E drops the traffic creating the black hole. To avoid this problem, you should configure the summary address with an administrative distance on only single-homed remote routers or areas in which only one exit point exists between the segments of the network. If two or more exit points exist (from one segment of the network to another), configuring the floating default route can cause a black hole to form.

## Split Horizon for an EIGRP Process

Split horizon controls the sending of EIGRP update and query packets. When split horizon is enabled on an interface, update and query packets are not sent for destinations for which this interface is the next hop. Controlling update and query packets in this manner reduces the possibility of routing loops.

By default, split horizon is enabled on all interfaces.

Split horizon blocks route information from being advertised by a router on any interface from which that information originated. This behavior usually optimizes communications among multiple routing devices, particularly when links are broken. However, with nonbroadcast networks (such as Frame Relay and SMDS), situations can arise for which this behavior is less than ideal. For these situations, including networks in which you have EIGRP configured, you may want to disable split horizon.

## Adjustment of Hello Interval and Hold Time for an EIGRP Process

You can adjust the interval between hello packets and the hold time.

Routing devices periodically send hello packets to each other to dynamically learn of other routers on their directly attached networks. This information is used to discover neighbors and learn when neighbors become unreachable or inoperative. By default, hello packets are sent every 5 seconds.

You can configure the hold time on a specified interface for a particular EIGRP routing process designated by the autonomous system number. The hold time is advertised in hello packets and indicates to neighbors the length of time they should consider the sender valid. The default hold time is three times the hello interval, or 15 seconds.

## Stub Routing for an EIGRP Process

The EIGRP Stub Routing feature improves network stability, reduces resource usage, and simplifies stub router configuration.

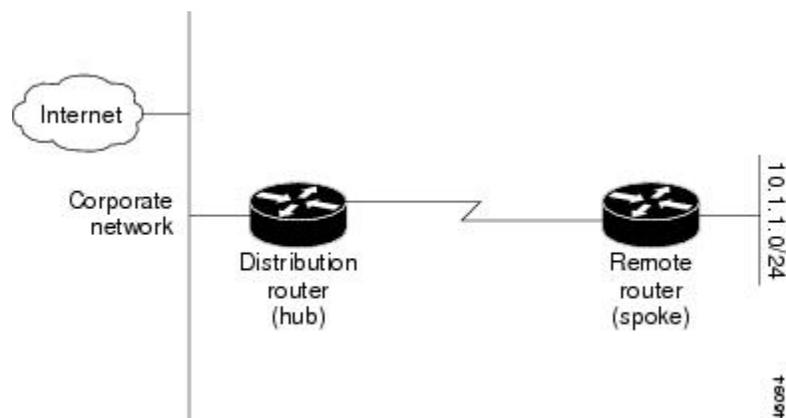
Stub routing is commonly used in a hub-and-spoke network topology. In a hub-and-spoke network, one or more end (stub) networks are connected to a remote router (the spoke) that is connected to one or more distribution routers (the hub). The remote router is adjacent only to one or more distribution routers. The only route for IP traffic to follow into the remote router is through a distribution router. This type of configuration is commonly used in WAN topologies in which the distribution router is directly connected to a WAN. The distribution router can be connected to many more remote routers. Often, the distribution router is connected to 100 or more remote routers. In a hub-and-spoke topology, the remote router must forward all nonlocal traffic to a distribution router, so it becomes unnecessary for the remote router to hold a complete routing table. Generally, the distribution router need not send anything more than a default route to the remote router.

When using the EIGRP Stub Routing feature, you need to configure the distribution and remote routers to use EIGRP and configure only the remote router as a stub. Only specified routes are propagated from the remote (stub) router. The stub router responds to all queries for summaries, connected routes, redistributed static routes, external routes, and internal routes with the message “inaccessible.” A router that is configured as a stub sends a special peer information packet to all neighboring routers to report its status as a stub router.

Any neighbor that receives a packet informing it of the stub status does not query the stub router for any routes, and a router that has a stub peer does not query that peer. The stub router depends on the distribution router to send the proper updates to all peers.

**Figure 3: Simple Hub-and-Spoke Network**

This figure shows a simple hub-and-spoke configuration.



The stub routing feature by itself does not prevent routes from being advertised to the remote router. In the example in [Figure 3: Simple Hub-and-Spoke Network, on page 9](#), the remote router can access the corporate

network and the Internet through the distribution router only. Having a full route table on the remote router, in this example, would serve no functional purpose because the path to the corporate network and the Internet would always be through the distribution router. The larger route table would only reduce the amount of memory required by the remote router. Bandwidth and memory can be conserved by summarizing and filtering routes in the distribution router. The remote router need not receive routes that have been learned from other networks because the remote router must send all nonlocal traffic, regardless of destination, to the distribution router. If a true stub network is desired, the distribution router should be configured to send only a default route to the remote router. The EIGRP Stub Routing feature does not automatically enable summarization on the distribution router. In most cases, the network administrator needs to configure summarization on the distribution routers.

Without the stub feature, even after the routes that are sent from the distribution router to the remote router have been filtered or summarized, a problem might occur. If a route is lost somewhere in the corporate network, EIGRP could send a query to the distribution router, which in turn sends a query to the remote router even if routes are being summarized. If there is a problem communicating over the WAN link between the distribution router and the remote router, an EIGRP stuck in active (SIA) condition could occur and cause instability elsewhere in the network. The EIGRP Stub Routing feature allows a network administrator to prevent queries from being sent to the remote router.

## Route Policy Options for an EIGRP Process

Route policies comprise series of statements and expressions that are bracketed with the **route-policy** and **end-policy** keywords. Rather than a collection of individual commands (one for each line), the statements within a route policy have context relative to each other. Thus, instead of each line being an individual command, each policy or set is an independent configuration object that can be used, entered, and manipulated as a unit.

Each line of a policy configuration is a logical subunit. At least one new line must follow the **then**, **else**, and **end-policy** keywords. A new line must also follow the closing parenthesis of a parameter list and the name string in a reference to an AS path set, community set, extended community set, or prefix set (in the EIGRP context). At least one new line must precede the definition of a route policy or prefix set. A new line must appear at the end of a logical unit of policy expression and may not appear anywhere else.

This is the command to set the EIGRP metric in a route policy:

```
RP/0/RP0/CPU0:router(config-rpl)# set eigrp-metric bandwidth delay reliability loading mtu
```

This is the command to provide EIGRP offset list functionality in a route policy:

```
RP/0/RP0/CPU0:router(config-rpl)# add eigrp-metric bandwidth delay reliability loading mtu
```

A route policy can be used in EIGRP only if all the statements are applicable to the particular EIGRP attach point. The following commands accept a route policy:

- **default-information allowed**—Match statements are allowed for destination. No set statements are allowed.
- **route-policy**—Match statements are allowed for destination, next hop, and tag. Set statements are allowed for eigrp-metric and tag.
- **redistribute**—Match statements are allowed for destination, next hop, source-protocol, tag and route-type. Set statements are allowed for eigrp-metric and tag.

The range for setting a tag is 0 to 255 for internal routes and 0 to 4294967295 for external routes.

## EIGRP v4/v6 Authentication Using Keychain

EIGRP authentication using keychain introduces the capability to authenticate EIGRP protocol packets on a per-interface basis. The EIGRP routing authentication provides a mechanism to authenticate all EIGRP protocol traffic on one or more interfaces, based on Message Digest 5 (MD5) authentication.

The EIGRP routing authentication uses the Cisco IOS XR software security keychain infrastructure to store and retrieve secret keys and to authenticate incoming and outgoing traffic on a per-interface basis.

## How to Implement EIGRP

This section contains instructions for the following tasks:



**Note** To save configuration changes, you must commit changes when the system prompts you.

## Enabling EIGRP Routing

This task enables EIGRP routing and establishes an EIGRP routing process.

### Before you begin

Although you can configure EIGRP before you configure an IP address, no EIGRP routing occurs until at least one IP address is configured.

### SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **address-family** { **ipv4** }
4. **router-id** *id*
5. **default-metric** *bandwidth delay reliability loading mtu*
6. **distance** *internal-distance external-distance*
7. **interface** *type interface-path-id*
8. **holdtime** *seconds*
9. **bandwidth-percent** *percent*
10. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b>  <b>Example:</b>	Enters XR Config mode.

	Command or Action	Purpose
	RP/0/RP0/CPU0:router# configure	
<b>Step 2</b>	<b>router eigrp</b> <i>as-number</i> <b>Example:</b> RP/0/RP0/CPU0:router(config)# router eigrp 100	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
<b>Step 3</b>	<b>address-family</b> { <i>ipv4</i> } <b>Example:</b> RP/0/RP0/CPU0:router(config-eigrp)# address-family ipv4	Enters an address family configuration mode.
<b>Step 4</b>	<b>router-id</b> <i>id</i> <b>Example:</b> RP/0/RP0/CPU0:router(config-eigrp)# router-id 172.20.1.1	(Optional) Configures a router-id for an EIGRP process. <b>Note</b> It is good practice to use the <b>router-id</b> command to explicitly specify a unique 32-bit numeric value for the router ID. This action ensures that EIGRP can function regardless of the interface address configuration.
<b>Step 5</b>	<b>default-metric</b> <i>bandwidth delay reliability loading mtu</i> <b>Example:</b> RP/0/RP0/CPU0:router(config-eigrp-af)# default-metric 1000 100 250 100 1500	(Optional) Sets metrics for an EIGRP process.
<b>Step 6</b>	<b>distance</b> <i>internal-distance external-distance</i> <b>Example:</b> RP/0/RP0/CPU0:router(config-eigrp-af)# distance 80 130	(Optional) Allows the use of two administrative distances—internal and external—that could be a better route to a node.
<b>Step 7</b>	<b>interface</b> <i>type interface-path-id</i> <b>Example:</b> RP/0/RP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/1/0/0	Defines the interfaces on which the EIGRP routing protocol runs.
<b>Step 8</b>	<b>holdtime</b> <i>seconds</i> <b>Example:</b> RP/0/RP0/CPU0:router(config-eigrp-af-if)# holdtime 30	(Optional) Configures the hold time for an interface.
<b>Step 9</b>	<b>bandwidth-percent</b> <i>percent</i> <b>Example:</b>	(Optional) Configures the percentage of bandwidth that may be used by EIGRP on an interface.

	Command or Action	Purpose
	RP/0/RP0/CPU0:router (config-eigrp-af-if) # bandwidth-percent 75	
<b>Step 10</b>	Use the <b>commit</b> or <b>end</b> command.	<p><b>commit</b> —Saves the configuration changes and remains within the configuration session.</p> <p><b>end</b> —Prompts user to take one of these actions:</p> <ul style="list-style-type: none"> <li>• <b>Yes</b> — Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> —Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> —Remains in the configuration session, without committing the configuration changes.</li> </ul>

## Configuring Route Summarization for an EIGRP Process

This task configures route summarization for an EIGRP process.

You can configure a summary aggregate address for a specified interface. If any more specific routes are in the routing table, EIGRP advertises the summary address from the interface with a metric equal to the minimum of all more specific routes.

### Before you begin



**Note** You should not use the **summary-address** summarization command to generate the default route (0.0.0.0) from an interface. This command creates an EIGRP summary default route to the null 0 interface with an administrative distance of 5. The low administrative distance of this default route can cause this route to displace default routes learned from other neighbors from the routing table. If the default route learned from the neighbors is displaced by the summary default route or the summary route is the only default route present, all traffic destined for the default route does not leave the router; instead, this traffic is sent to the null 0 interface, where it is dropped.

The recommended way to send only the default route from a given interface is to use a **route-policy** command.

### SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **address-family** { **ipv4** }
4. **route-policy** *name out*
5. **interface** *type interface-path-id*
6. **summary-address** *ip-address* { */ length / mask* } [ *admin-distance* ]
7. Use the **commit** or **end** command.

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b>  RP/0/RP0/CPU0:router# configure	Enters XR Config mode.
<b>Step 2</b>	<b>router eigrp as-number</b> <b>Example:</b>  RP/0/RP0/CPU0:router(config)# router eigrp 100	Specifies the AS number of the routing process to configure an EIGRP routing process
<b>Step 3</b>	<b>address-family { ipv4 }</b> <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp)# address-family ipv4	Enters an address family configuration mode.
<b>Step 4</b>	<b>route-policy name out</b> <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp-af)# route-policy FILTER_DEFAULT out	Applies a routing policy to updates advertised to or received from an EIGRP neighbor.
<b>Step 5</b>	<b>interface type interface-path-id</b> <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/1/0/0	Defines the interfaces on which the EIGRP routing protocol runs.
<b>Step 6</b>	<b>summary-address ip-address { /length /mask } [ admin-distance ]</b> <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp-af-if)# summary-address 192.168.0.0/16 95	Configures a summary aggregate address for the specified EIGRP interface.
<b>Step 7</b>	Use the <b>commit</b> or <b>end</b> command.	<p><b>commit</b> —Saves the configuration changes and remains within the configuration session.</p> <p><b>end</b> —Prompts user to take one of these actions:</p> <ul style="list-style-type: none"> <li>• <b>Yes</b> — Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> —Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> —Remains in the configuration session, without committing the configuration changes.</li> </ul>

## Redistributing Routes for EIGRP

This task explains how to redistribute routes, apply limits on the number of routes, and set timers for nonstop forwarding.

### SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **address-family** { **ipv4** | **ipv6** }
4. **redistribute** {{ **bgp** | **connected** | **isis** | **ospf** | **ospfv3** | **rip** | **static** } [ *as-number* ] [ **route-policy** *name* ]
5. **redistribute maximum-prefix** *maximum* [ *threshold* ] [[ **dampened** ] [ **reset-time** *minutes* ] [ **restart** *minutes* ] [ **restart-count** *number* ] | [ **warning-only** ]]
6. **timers nsf route-hold** *seconds*
7. **maximum paths** *maximum*
8. **maximum-prefix** *maximum* [ *threshold* ] [[ **dampened** ] [ **reset-time** *minutes* ] [ **restart** *minutes* ] [ **restart-count** *number* ] | [ **warning-only** ]]
9. Use the **commit** or **end** command.

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure</b>  <b>Example:</b>  RP/0/RP0/CPU0:router# <code>configure</code>	Enters XR Config mode.
Step 2	<b>router eigrp</b> <i>as-number</i>  <b>Example:</b>  RP/0/RP0/CPU0:router(config)# <code>router eigrp 100</code>	Specifies the AS number of the routing process to configure an EIGRP routing process.
Step 3	<b>address-family</b> { <b>ipv4</b>   <b>ipv6</b> }  <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp)# <code>address-family ipv4</code>	Enters an address family configuration mode.
Step 4	<b>redistribute</b> {{ <b>bgp</b>   <b>connected</b>   <b>isis</b>   <b>ospf</b>   <b>ospfv3</b>   <b>rip</b>   <b>static</b> } [ <i>as-number</i> ] [ <b>route-policy</b> <i>name</i> ]  <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp-af)# <code>redistribute bgp 100</code>	Redistributes the routes from the specified protocol and AS number to the EIGRP process. Optionally, the redistributed routes can be filtered into the EIGRP process by providing the route policy.
Step 5	<b>redistribute maximum-prefix</b> <i>maximum</i> [ <i>threshold</i> ] [[ <b>dampened</b> ] [ <b>reset-time</b> <i>minutes</i> ] [ <b>restart</b> <i>minutes</i> ] [ <b>restart-count</b> <i>number</i> ]   [ <b>warning-only</b> ]]	Limits the maximum number of prefixes that are redistributed to the EIGRP process.

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-eigrp-af)# redistribute maximum-prefix 5000 95 warning-only</pre>	<p><b>Caution</b> After the restart count threshold is crossed, you need to use the <code>clear eigrp neighbors</code> command to re-establish normal peering, redistribution, or both.</p>
<b>Step 6</b>	<p><b>timers nsf route-hold</b> <i>seconds</i></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-eigrp-af)# timers nsf route-hold 120</pre>	Sets the timer that determines how long an NSF-aware EIGRP router holds routes for an inactive peer.
<b>Step 7</b>	<p><b>maximum paths</b> <i>maximum</i></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-eigrp-af)# maximum paths 10</pre>	Controls the maximum number of parallel routes that the EIGRP can support.
<b>Step 8</b>	<p><b>maximum-prefix</b> <i>maximum</i> [<i>threshold</i>] [[ <b>dampened</b> ] ] [ <b>reset-time</b> <i>minutes</i> ] [ <b>restart</b> <i>minutes</i> ] [ <b>restart-count</b> <i>number</i> ] [ <b>warning-only</b> ]</p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router(config-eigrp-af)# maximum-prefix 50000</pre>	Limits the number of prefixes that are accepted under an address family by EIGRP.
<b>Step 9</b>	Use the <b>commit</b> or <b>end</b> command.	<p><b>commit</b> —Saves the configuration changes and remains within the configuration session.</p> <p><b>end</b> —Prompts user to take one of these actions:</p> <ul style="list-style-type: none"> <li>• <b>Yes</b> — Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> —Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> —Remains in the configuration session, without committing the configuration changes.</li> </ul>

## Creating a Route Policy and Attaching It to an EIGRP Process

This task defines a route policy and shows how to attach it to an EIGRP process.

A route policy definition consists of the **route-policy** command and *name* argument followed by a sequence of optional policy statements, and then closed with the **end-policy** command.

A route policy is not useful until it is applied to routes of a routing protocol.

### SUMMARY STEPS

1. **configure**

2. **route-policy** *name*
3. **set eigrp-metric** *bandwidth delay reliability load mtu*
4. **end-policy**
5. Use the **commit** or **end** command.
6. **configure**
7. **router eigrp** *as-number*
8. **address-family** { **ipv4** | **ipv6** }
9. **route-policy** *route-policy-name* { **in** | **out** }
10. Use the **commit** or **end** command.

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b>  <b>Example:</b>  RP/0/RP0/CPU0:router# configure	Enters XR Config mode.
<b>Step 2</b>	<b>route-policy</b> <i>name</i>  <b>Example:</b>  RP/0/RP0/CPU0:router(config)# route-policy IN-IPv4	Defines a route policy and enters route-policy configuration mode.
<b>Step 3</b>	<b>set eigrp-metric</b> <i>bandwidth delay reliability load mtu</i>  <b>Example:</b>  RP/0/RP0/CPU0:router(config-rpl)# set eigrp metric 42 100 200 100 1200	(Optional) Sets the EIGRP metric attribute.
<b>Step 4</b>	<b>end-policy</b>  <b>Example:</b>  RP/0/RP0/CPU0:router(config-rpl)# end-policy	Ends the definition of a route policy and exits route-policy configuration mode.
<b>Step 5</b>	Use the <b>commit</b> or <b>end</b> command.	<p><b>commit</b> —Saves the configuration changes and remains within the configuration session.</p> <p><b>end</b> —Prompts user to take one of these actions:</p> <ul style="list-style-type: none"> <li>• <b>Yes</b> — Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> —Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> —Remains in the configuration session, without committing the configuration changes.</li> </ul>

	Command or Action	Purpose
<b>Step 6</b>	<b>configure</b> <b>Example:</b>  RP/0/RP0/CPU0:router# configure	Enters XR Config mode.
<b>Step 7</b>	<b>router eigrp</b> <i>as-number</i> <b>Example:</b>  RP/0/RP0/CPU0:router(config)# router eigrp 100	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
<b>Step 8</b>	<b>address-family</b> { <i>ipv4</i>   <i>ipv6</i> } <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp)# address-family <i>ipv4</i>	Enters an address family configuration mode.
<b>Step 9</b>	<b>route-policy</b> <i>route-policy-name</i> { <i>in</i>   <i>out</i> } <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp-af)# route-policy <i>IN-IPv4 in</i>	Applies a routing policy to updates advertised to or received from an EIGRP neighbor.
<b>Step 10</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> —Saves the configuration changes and remains within the configuration session.  <b>end</b> —Prompts user to take one of these actions:  • <b>Yes</b> — Saves configuration changes and exits the configuration session.  • <b>No</b> —Exits the configuration session without committing the configuration changes.  • <b>Cancel</b> —Remains in the configuration session, without committing the configuration changes.

## Configuring Stub Routing for an EIGRP Process

This task configures the distribution and remote routers to use an EIGRP process for stub routing.

### Before you begin



**Note** EIGRP stub routing should be used only on remote routers. A stub router is defined as a router connected to the network core or distribution layer through which core transit traffic should not flow. A stub router should not have any EIGRP neighbors other than distribution routers. Ignoring this restriction causes undesirable behavior.

## SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **address-family** { **ipv4** }
4. **stub** [ **receive-only** | {[ **connected** ] [ **redistributed** ] [ **static** ] [ **summary** ]}]
5. Use the **commit** or **end** command.
6. **show eigrp** [ **ipv4** ] **neighbors** [ *as-number* ] [ **detail** ] [ *type interface-path-id* | **static** ]

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b> <b>Example:</b>  RP/0/RP0/CPU0:router# <code>configure</code>	Enters XR Config mode.
<b>Step 2</b>	<b>router eigrp</b> <i>as-number</i> <b>Example:</b>  RP/0/RP0/CPU0:router(config)# <code>router eigrp 100</code>	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
<b>Step 3</b>	<b>address-family</b> { <b>ipv4</b> } <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp)# <code>address-family ipv4</code>	Enters an address family configuration mode.
<b>Step 4</b>	<b>stub</b> [ <b>receive-only</b>   {[ <b>connected</b> ] [ <b>redistributed</b> ] [ <b>static</b> ] [ <b>summary</b> ]}] <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp-af)# <code>stub receive-only</code>	Configures a router as a stub for EIGRP.
<b>Step 5</b>	Use the <b>commit</b> or <b>end</b> command.	<b>commit</b> —Saves the configuration changes and remains within the configuration session. <b>end</b> —Prompts user to take one of these actions: <ul style="list-style-type: none"> <li>• <b>Yes</b> — Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> —Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> —Remains in the configuration session, without committing the configuration changes.</li> </ul>
<b>Step 6</b>	<b>show eigrp</b> [ <b>ipv4</b> ] <b>neighbors</b> [ <i>as-number</i> ] [ <b>detail</b> ] [ <i>type interface-path-id</i>   <b>static</b> ]	Verifies that a remote router has been configured as a stub router with EIGRP.

Command or Action	Purpose
<b>Example:</b>  RP/0/RP0/CPU0:router# show eigrp neighbors detail	The last line of the output shows the stub status of the remote or spoke router.

## Monitoring EIGRP Routing

The commands in this section are used to log neighbor adjacency changes, monitor the stability of the routing system, and help detect problems.

### SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **address-family** [ **ipv4** | **ipv6** ]
4. **log-neighbor-changes**
5. **log-neighbor-warnings**
6. Use the **commit** or **end** command.
7. **clear eigrp** [ *as-number* ] [ **ipv4** | **ipv6** ] **neighbors** [ *ip-address* | *type interface-path-id* ]
8. **clear eigrp** [ *as-number* ] [ **ipv4** | **ipv6** ] **topology** [ *prefix mask* ] [ *prefix / length* ]
9. **show eigrp** [ *as-number* ] [ **ipv4** | **ipv6** ] **interfaces** [ *type interface-path-id* ] [ **detail** ]
10. **show eigrp** [ *as-number* ] [ **ipv4** | **ipv6** ] **neighbors** [ **detail** ] [ *type interface-path-id* | **static** ]
11. **show protocols eigrp**
12. **show eigrp** [ *as-number* ] [ **ipv4** | **ipv6** ] **topology** [ *ip-address mask* ] [ **active** | **all-links** | **detail-links** | **pending** | **summary** | **zero-successors** ]
13. **show eigrp** [ *as-number* ] [ **ipv4** | **ipv6** ] **traffic**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure</b>  <b>Example:</b>  RP/0/RP0/CPU0:router# configure	Enters XR Config mode.
<b>Step 2</b>	<b>router eigrp</b> <i>as-number</i>  <b>Example:</b>  RP/0/RP0/CPU0:router(config)# router eigrp 100	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
<b>Step 3</b>	<b>address-family</b> [ <b>ipv4</b>   <b>ipv6</b> ]  <b>Example:</b>  RP/0/RP0/CPU0:router(config-eigrp)# <b>address-family</b> <b>ipv4</b>	Enters an address family configuration mode.

	Command or Action	Purpose
Step 4	<p><b>log-neighbor-changes</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router (config-eigrp-af) # log-neighbor-changes</pre>	Enables the logging of changes in EIGRP neighbor adjacencies.
Step 5	<p><b>log-neighbor-warnings</b></p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router (config-eigrp-af) # log-neighbor-warnings</pre>	Enables the logging of EIGRP neighbor warning messages.
Step 6	Use the <b>commit</b> or <b>end</b> command.	<p><b>commit</b> —Saves the configuration changes and remains within the configuration session.</p> <p><b>end</b> —Prompts user to take one of these actions:</p> <ul style="list-style-type: none"> <li>• <b>Yes</b> — Saves configuration changes and exits the configuration session.</li> <li>• <b>No</b> —Exits the configuration session without committing the configuration changes.</li> <li>• <b>Cancel</b> —Remains in the configuration session, without committing the configuration changes.</li> </ul>
Step 7	<p><b>clear eigrp</b> [ <i>as-number</i> ] [ <b>ipv4</b>   <b>ipv6</b> ] <b>neighbors</b> [ <i>ip-address</i>   <i>type interface-path-id</i> ]</p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router# clear eigrp 20 neighbors 0/1/0/0</pre>	Deletes EIGRP neighbor entries from the appropriate table.
Step 8	<p><b>clear eigrp</b> [ <i>as-number</i> ] [ <b>ipv4</b>   <b>ipv6</b> ] <b>topology</b> [ <i>prefix mask</i> ] [ <i>prefix / length</i> ]</p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router# clear eigrp topology</pre>	Deletes EIGRP topology entries from the appropriate table.
Step 9	<p><b>show eigrp</b> [ <i>as-number</i> ] [ <b>ipv4</b>   <b>ipv6</b> ] <b>interfaces</b> [ <i>type interface-path-id</i> ] [ <b>detail</b> ]</p> <p><b>Example:</b></p> <pre>RP/0/RP0/CPU0:router# show eigrp interfaces detail</pre>	Displays information about interfaces configured for EIGRP.
Step 10	<p><b>show eigrp</b> [ <i>as-number</i> ] [ <b>ipv4</b>   <b>ipv6</b> ] <b>neighbors</b> [ <b>detail</b> ] [ <i>type interface-path-id</i>   <b>static</b> ]</p> <p><b>Example:</b></p>	Displays the neighbors discovered by EIGRP.

	Command or Action	Purpose
	RP/0/RP0/CPU0:router# show eigrp neighbors 20 detail static	
<b>Step 11</b>	<b>show protocols eigrp</b> <b>Example:</b>  RP/0/RP0/CPU0:router# show protocols eigrp	Displays information about the EIGRP process configuration.
<b>Step 12</b>	<b>show eigrp [ as-number ] [ ipv4   ipv6 ] topology [ ip-address mask ] [ active   all-links   detail-links   pending   summary   zero-successors ]</b> <b>Example:</b>  RP/0/RP0/CPU0:router# show eigrp topology 10.0.0.1 253.254.255.255 summary	Displays entries in the EIGRP topology table.
<b>Step 13</b>	<b>show eigrp [ as-number ] [ ipv4   ipv6 ] traffic</b> <b>Example:</b>  RP/0/RP0/CPU0:router# show eigrp traffic	Displays the number of EIGRP packets sent and received.

## Configuration Examples for Implementing EIGRP

This section provides the following configuration examples:

### Configuring a Basic EIGRP Configuration: Example

The following example shows how to configure EIGRP with a policy that filters incoming routes. This is a typical configuration for a router that has just one neighbor, but advertises other connected subnets.

```
router eigrp 144
  address-family ipv4
    metric maximum-hops 20
    router-id 10.10.9.4
    route-policy GLOBAL_FILTER_POLICY in
    log-neighbor-changes
    log-neighbor-warnings
  interface Loopback0
  !
  interface GigabitEthernet 0/2/0/0
    passive-interface
  !
  interface GigabitEthernet 0/6/0/0
    hello-interval 8
    hold-time 30
    summary-address 10.0.0.0 255.255.0.0
  !
```

## Configuring an EIGRP Stub Operation: Example

The following example shows how to configure an EIGRP stub. Stub operation allows only connected, static, and summary routes to be advertised to neighbors.

```
router eigrp 200
  address-family ipv4
    stub connected static summary
    router-id 172.16.82.22
    log-neighbor-changes
    log-neighbor-warnings
    redistribute connected route-policy CONN_POLICY
    interface GigabitEthernet0/6/0/0
      passive-interface
      neighbor 10.0.0.31
    !
    interface GigabitEthernet0/6/0/1
      passive-interface
      neighbor 10.0.1.21
    !
  !
!
```

## Additional References

The following sections provide references related to implementing EIGRP.

### Related Documents

Related Topic	Document Title
EIGRP commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Routing Command Reference for Cisco NCS 6000 Series Routers</i>
Site of Origin (SoO) support for EIGRP feature information	<i>Implementing MPLS Traffic Engineering on module in MPLS Configuration Guide for Cisco NCS 6000 Series Routers</i>

### Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

**MIBs**

MIBs	MIBs Link
—	To locate and download MIBs using Cisco IOS XR software, use the Cisco MIB Locator found at the following URL and choose a platform under the Cisco Access Products menu: <a href="https://mibs.cloudapps.cisco.com/ITDIT/MIBS/servlet/index">https://mibs.cloudapps.cisco.com/ITDIT/MIBS/servlet/index</a>

**RFCs**

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

**Technical Assistance**

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