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.

For EIGRP configuration information related to the following features, see the Related Documents, on page 40 section of this module.

- Multiprotocol Label Switching (MPLS) Layer 3 Virtual Private Network (VPN)
- Site of Origin (SoO) Support

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 ASR 9000 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	Modification
Release 3.7.2	This feature was introduced.
Release 4.3.0	Wide Metric Support feature was added
Release 6.0.1	Support for Site of origin (SoO) attribute was added

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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.

The following key features are supported in the Cisco IOS XR implementation:

- Provider Edge (PE)-Customer Edge (CE) protocol support with Site of Origin (SoO) and Border Gateway Protocol (BGP) cost community support.
- PECE protocol support for MPLS.

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. It supports intermixed transmission of multicast and unicast packets. Some EIGRP packets must be sent reliably and others need not be. For efficiency, reliability is provided only when necessary. For example, on a multiaccess network that has multicast capabilities (such as Ethernet) it is not necessary to send hello packets reliably to all neighbors individually. Therefore, EIGRP sends a single multicast hello with an indication in the packet informing the receivers that the packet need not be acknowledged. Other types of packets (such as updates) require acknowledgment, which is indicated in the packet. The reliable transport has a provision to send multicast packets quickly when unacknowledged packets are pending. This provision helps to ensure that convergence time remains low in the presence of various speed links.

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:

```
RP/0/RSP0/CPU0:router# configuration
RP/0/RSP0/CPU0:router(config)# router eigrp 100
RP/0/RSP0/CPU0:router(config-eigrp)#
```

VRF Configuration Mode

The following example shows how to enter VRF configuration mode:

```
RP/0/RSP0/CPU0:router# configuration
RP/0/RSP0/CPU0:router(config)# router eigrp 100
RP/0/RSP0/CPU0:router(config-eigrp)# vrf customer1
RP/0/RSP0/CPU0:router(config-eigrp-vrf)#
```

IPv4 Address Family Configuration Mode

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

```
RP/0/RSP0/CPU0:router# configuration
RP/0/RSP0/CPU0:router(config)# router eigrp 100
RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4
RP/0/RSP0/CPU0:router(config-eigrp-af)#
```

IPv4 VRF Address Family Configuration Mode

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

```
RP/0/RSP0/CPU0:router# configuration
RP/0/RSP0/CPU0:router(config)# router eigrp 100
RP/0/RSP0/CPU0:router(config-eigrp)# vrf customer1
RP/0/RSP0/CPU0:router(config-eigrp-vrf)# address-family ipv4
RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)#
```

Interface Configuration Mode

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

```
RP/0/RSP0/CPU0:router# configuration
RP/0/RSP0/CPU0:router(config)# router eigrp 100
RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4
RP/0/RSP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/3/0/0
RP/0/RSP0/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. When redistribution is configured under a VRF, EIGRP retrieves extended communities attached to the route in the routing information base (RIB). The SoO is used to filter out routing loops in the presence of MPSL VPN backdoor links.

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/RSP0/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/RSP0/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/RSP0/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).

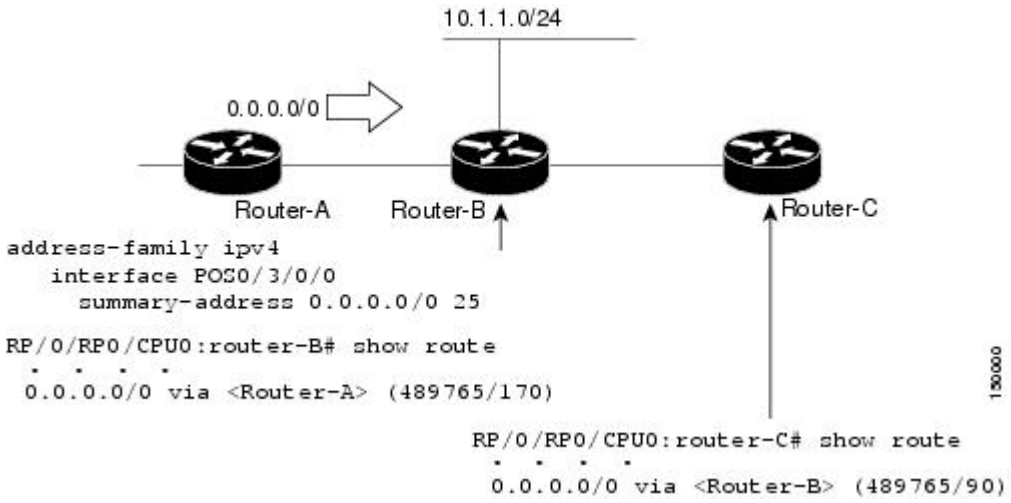
Floating Summary Routes for an EIGRP Process

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 8 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/RSP0/CPU0:router(config)# router eigrp 100
RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4
RP/0/RSP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/3/0/0
RP/0/RSP0/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:

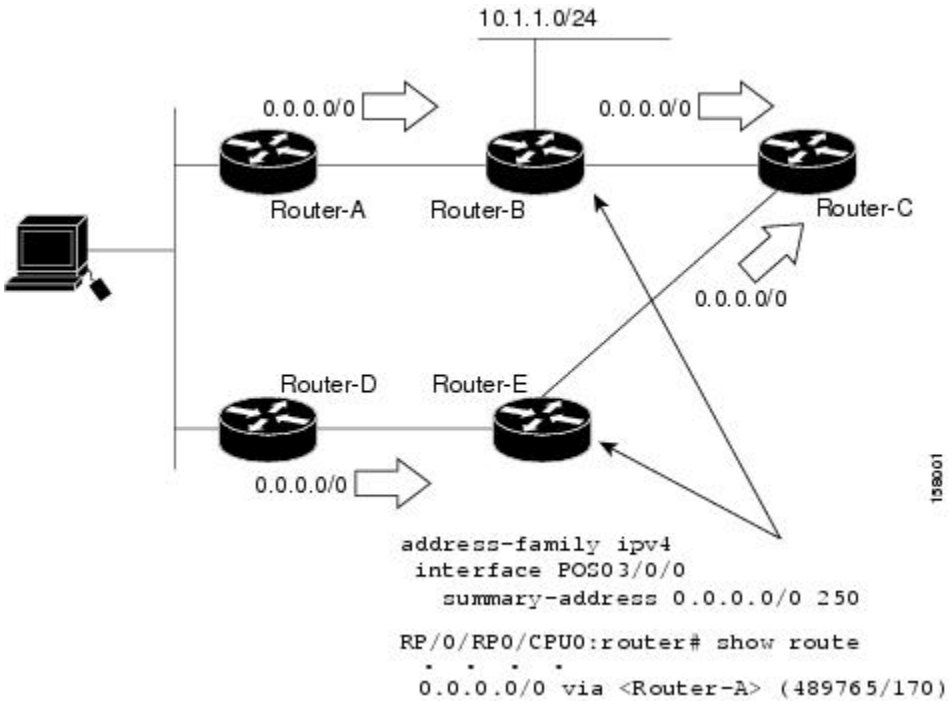
```
RP/0/RSP0/CPU0:router(config-if)# summary-address 100 0.0.0.0 0.0.0.0 250
```

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 9 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.

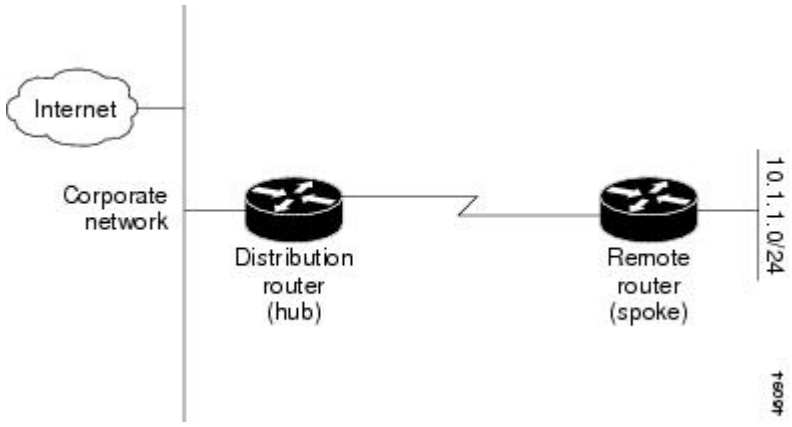
Stub routing is commonly used in a hub-and-spoke network topology. In a hub-and-spoke network, one or more end (stub) networks are connected to a remote router (the spoke) that is connected to one or more distribution routers (the hub). The remote router is adjacent only to one or more distribution routers. 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 10 , 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/RSP0/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/RSP0/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 Layer 3 VPN PE-CE Site-of-Origin

The EIGRP MPLS and IP VPN PE-CE Site-of-Origin (SoO) feature introduces the capability to filter Multiprotocol Label Switching (MPLS) and IP Virtual Private Network (VPN) traffic on a per-site basis for EIGRP networks. SoO filtering is configured at the interface level and is used to manage MPLS and IP VPN traffic and to prevent transient routing loops from occurring in complex and mixed network topologies.

Router Interoperation with the Site-of-Origin Extended Community

The configuration of the SoO extended community allows routers that support this feature to identify the site from which each route originated. When this feature is enabled, the EIGRP routing process on the PE or CE router checks each received route for the SoO extended community and filters based on the following conditions:

- A received route from BGP or a CE router contains a SoO value that matches the SoO value on the receiving interface:
  - If a route is received with an associated SoO value that matches the SoO value that is configured on the receiving interface, the route is filtered out because it was learned from another PE router or from a backdoor link. This behavior is designed to prevent routing loops.
- A received route from a CE router is configured with a SoO value that does not match:
  - If a route is received with an associated SoO value that does not match the SoO value that is configured on the receiving interface, the route is accepted into the EIGRP topology table so that it can be redistributed into BGP.
  - If the route is already installed in the EIGRP topology table but is associated with a different SoO value, the SoO value from the topology table is used when the route is redistributed into BGP.
- A received route from a CE router does not contain a SoO value:
  - If a route is received without a SoO value, the route is accepted into the EIGRP topology table, and the SoO value from the interface that is used to reach the next-hop CE router is appended to the route before it is redistributed into BGP.

When BGP and EIGRP peers that support the SoO extended community receive these routes, they also receive the associated SoO values and pass them to other BGP and EIGRP peers that support the SoO extended community. This filtering is designed to prevent transient routes from being relearned from the originating site, which prevents transient routing loops from occurring.

In conjunction with BGP cost community, EIGRP, BGP, and the RIB ensure that paths over the MPLS VPN core are preferred over backdoor links.

For MPLS and IP VPN and SoO configuration information, see *Implementing MPLS Layer 3 VPNs* in the *Cisco ASR 9000 Series Aggregation Services Router MPLS Configuration Guide*.

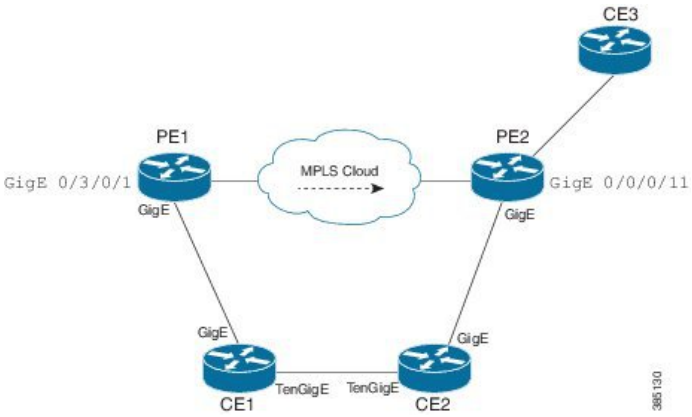
Route Manipulation using SoO match condition

The SoO configuration in EIGRP network can be used to manipulate routes using the SoO match condition in the routing policy. The egress interface of a PE router is used to compare and manipulate routes based on the SoO configuration on the remote PE router.

Topology

In the following topology, CE1, CE2 and CE3 are the customer edge routers. PE1 and PE2 are the provider edge routers. By default, CE1 will use PE1->PE2 to reach CE3.To configure CE1 to use CE2 to reach CE3, the metric advertised by PE1 must be increased.

The routing policy on PE1 manipulates routes received from CE3 via PE2, by using the SoO match condition. With this feature added, PE1 can increase the metric while advertising routes to CE1.



Configuration:

```
/*SoO tag is assigned on PE2 router*/

router(config)#interface GigabitEthernet0/0/0/11
router (config-if)#site-of-origin 33.33.33.33:33

/* A route-policy defined on PE1 */

router(config)#route-policy test
router(config-rpl)#if extcommunity soo matches-any (33.33.33.33:33) then
router(config-rpl-if)#set eigrp-metric 2121212121 333333333 245 250 1455
router(config-rpl-if)#endif
router(config-rpl)#end-policy
router (config)#commit
router (config)#

router(config)#interface GigabitEthernet0/3/0/1
router (config-if)#route-policy test out
```

Verification:

```
/*A route with poor metric advertised by PE1 is installed into CE1's routing table for SoO
 of site C3. */

router#show eigrp topology 6:6::1/128

IPv6-EIGRP AS(100): Topology entry for 6:6::1/128
  State is Passive, Query origin flag is 1, 1 Successor(s), FD is 15539149614794, RIB is
4294967295 Routing Descriptor Blocks: fe80::226:98ff:fe24:5109 (GigabitEthernet0/0/0/15),
from fe80::226:98ff:fe24:5109, Send flag is 0x0
Composite metric is (15539149614794/15539148304382), Route is Internal Vector metric:
Minimum bandwidth is 1000000 Kbit
Total delay is 237108596182784 picoseconds
Reliability is 245/255
Load is 250/255
```

```
Minimum MTU is 1455
Hop count is 2
Originating router is 2.2.2.2
Extended Community:
SoO:33.33.33.33:33
```

Note:

This feature is applicable to both ipv4 as well as ipv6.

All types of SoO(IP-Address, ASN2, ASN4) are supported.

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.

EIGRP Wide Metric Computation

The Cisco IOS XR Enhanced Interior Gateway Routing Protocol (EIGRP) implementation is enhanced to perform wide metric computation. This enhancement is to support high bandwidth interfaces.

A new EIGRP command is added and existing EIGRP commands are enhanced to support wide metric computation feature.

- **metric rib-scale**—This command was introduced.
- **metric**—The **picoseconds** keyword was added.
- **metric weights**—Support was added for the *k6* constant.
- **show eigrp interfaces**—The command output was modified to display relevant wide metric information.
- **show eigrp neighbors** —The command output was modified to display relevant wide metric information.
- **show eigrp topology**—The command output was modified to display relevant wide metric information.
- **show protocols**—The command output was modified to display relevant wide metric information.

Note If there is a combination of IOS and IOS-XR PE devices in the network, then the EIGRP wide metric must be disabled in IOS-XR PE device. This is because the method of calculating metrics in L3VPN design between IOS and IOS-XR.

EIGRP Multi-Instance

The Enhanced Interior Gateway Routing Protocol (EIGRP) Multi-Instance feature allows multiple process instances to handle different routing instances and service the same VRF. Each process instance handles the routing instances configured under it. The multiple EIGRP process instance implementation allows to configure the EIGRP using a virtual-name in addition to an autonomous-system number.

EIGRP Support for BFD

EIGRP supports Bidirectional forwarding detection (BFD) for link failure detection.

BFD provides low-overhead, short-duration detection of failures in the path between adjacent forwarding engines. BFD allows a single mechanism to be used for failure detection over any media and at any protocol layer, with a wide range of detection times and overhead. The fast detection of failures provides immediate reaction to failure in the event of a failed link or neighbor.

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

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
Step 3	**address-family** { **ipv4** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4`	Enters an address family configuration mode.
Step 4	**router-id** *id* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# router-id 172.20.1.1`	(Optional) Configures a router-id for an EIGRP process. **Note** It is good practice to use the **router-id** 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.
Step 5	**default-metric** *bandwidth delay reliability loading mtu* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# default-metric 1000 100 250 100 1500`	(Optional) Sets metrics for an EIGRP process.
Step 6	**distance** *internal-distance external-distance* **Example:** `RP/0/RSP0/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.
Step 7	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/1/0/0`	Defines the interfaces on which the EIGRP routing protocol runs.
Step 8	**holdtime** seconds	(Optional) Configures the hold time for an interface.

	Command or Action	Purpose
	Example: `RP/0/RSP0/CPU0:router(config-eigrp-af-if)# holdtime 30`	**Note** To ensure nonstop forwarding during RP failovers, as the number of neighbors increase, a higher holdtime than the default value is recommended. With 256 neighbors across all VRFs, we recommend 60 seconds.
Step 9	**bandwidth-percent** *percent* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af-if)# bandwidth-percent 75`	(Optional) Configures the percentage of bandwidth that may be used by EIGRP on an interface.
Step 10	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

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

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the AS number of the routing process to configure an EIGRP routing process
Step 3	**address-family** { **ipv4** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4`	Enters an address family configuration mode.
Step 4	**route-policy** *name* **out** **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# route-policy FILTER_DEFAULT out`	Applies a routing policy to updates advertised to or received from an EIGRP neighbor.
Step 5	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# interface GigabitEthernet 0/1/0/0`	Defines the interfaces on which the EIGRP routing protocol runs.
Step 6	**summary-address** *ip-address* { / *length* | *mask* } [*admin-distance*] **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af-if)# summary-address 192.168.0.0/16 95`	Configures a summary aggregate address for the specified EIGRP interface.

	Command or Action	Purpose
Step 7	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

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** }
4. **redistribute** {{ **bgp** | **connected** | **isis** | **ospf** | **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

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:**	Specifies the AS number of the routing process to configure an EIGRP routing process.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router(config)# router eigrp 100`	
Step 3	**address-family** { **ipv4** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4`	Enters an address family configuration mode.
Step 4	**redistribute** {{ **bgp** | **connected** | **isis** | **ospf** | **rip** | **static** } [*as-number*]} [**route-policy** *name*] **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# redistribute bgp 100`	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	**redistribute maximum-prefix** *maximum* [*threshold*] [[**dampened**] [**reset-time** *minutes*] [**restart** *minutes*] [**restart-count** *number*] | [**warning-only**]] **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# redistribute maximum-prefix 5000 95 warning-only`	Limits the maximum number of prefixes that are redistributed to the EIGRP process. **Caution** After the restart count threshold is crossed, you need to use the `clear eigrp neighbors` command to re-establish normal peering, redistribution, or both.
Step 6	**timers nsf route-hold** *seconds* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# timers nsf route-hold 120`	Sets the timer that determines how long an NSF-aware EIGRP router holds routes for an inactive peer.
Step 7	**maximum paths** *maximum* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# maximum paths 10`	Controls the maximum number of parallel routes that the EIGRP can support.
Step 8	**maximum-prefix** *maximum* [*threshold*] [[**dampened**] [**reset-time** *minutes*] [**restart** *minutes*] [**restart-count** *number*] | [**warning-only]]** **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# maximum-prefix 50000`	Limits the number of prefixes that are accepted under an address family by EIGRP.
Step 9	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session.

	Command or Action	Purpose
		• **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

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** }
9. **route-policy** *route-policy-name* { **in** | **out** }
10. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**route-policy** *name* **Example:** `RP/0/RSP0/CPU0:router(config)# route-policy IN-IPv4`	Defines a route policy and enters route-policy configuration mode.
Step 3	**set eigrp-metric** *bandwidth delay reliability load mtu*	(Optional) Sets the EIGRP metric attribute.

	Command or Action	Purpose
	Example: `RP/0/RSP0/CPU0:router(config-rpl)# set eigrp metric 42 100 200 100 1200`	
Step 4	end-policy **Example:** `RP/0/RSP0/CPU0:router(config-rpl)# end-policy`	Ends the definition of a route policy and exits route-policy configuration mode.
Step 5	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.
Step 6	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 7	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
Step 8	**address-family** { **ipv4** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4`	Enters an address family configuration mode.
Step 9	**route-policy** *route-policy-name* { **in** | **out** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# route-policy IN-IPv4 in`	Applies a routing policy to updates advertised to or received from an EIGRP neighbor.
Step 10	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions:

	Command or Action	Purpose
		• **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —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

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.

	Command or Action	Purpose
Step 3	**address-family** { **ipv4** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4`	Enters an address family configuration mode.
Step 4	**stub** [**receive-only** | {[**connected**] [**redistributed**] [**static**] [**summary**]}] **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# stub receive-only`	Configures a router as a stub for EIGRP.
Step 5	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.
Step 6	**show eigrp** [**ipv4**] **neighbors** [*as-number*] [**detail**] [*type interface-path-id* | **static**] **Example:** `RP/0/RSP0/CPU0:router# show eigrp neighbors detail`	Verifies that a remote router has been configured as a stub router with EIGRP. The last line of the output shows the stub status of the remote or spoke router.

Configuring EIGRP as a PE-CE Protocol

Perform this task to configure EIGRP on the provider edge (PE) and establish provider edge-to-customer edge (PE-CE) communication using EIGRP.

SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **vrf** *vrf-name*
4. **address-family** { **ipv4** }
5. **router-id** *router-id*
6. **autonomous-system** *as-number*
7. **redistribute** {{ **bgp** | **connected** | **isis** | **ospf** | **ospfv3** | **rip** | **static** } [*as-number* | *instance-name*]} [**route-policy** *name*]

8. **interface** *type interface-path-id*
9. **site-of-origin** { *as-number:number* | *ip-address* **:** *number* }
10. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process
Step 3	**vrf** *vrf-name* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# vrf vrf_A`	Configures a VPN routing and forwarding (VRF) instance.
Step 4	**address-family** { **ipv4** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf)# address-family ipv4`	Enters a VRF address family configuration mode.
Step 5	**router-id** *router-id* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# router-id 33`	Configures a router ID for the EIGRP process.
Step 6	**autonomous-system** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# autonomous-system 2`	Configures an EIGRP routing process to run within the VRF instance. **Note** You must configure the autonomous system under VRF configuration to bring-up the VRF interface.
Step 7	**redistribute** {{ **bgp** | **connected** | **isis** | **ospf** | **ospfv3** | **rip** | **static** } [*as-number* | *instance-name*]} [**route-policy** *name*] **Example:**	Injects routes from one routing domain into EIGRP.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# redistribute bgp 100`	
Step 8	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# interface gigabitEthernet 0/1/5/0`	Configures the interface on which EIGRP the routing protocol runs.
Step 9	**site-of-origin** { *as-number:number* | *ip-address* **:** *number* } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af-if)# site-of-origin 3:4`	Configures the site-of-origin (SoO) filtering on the EIGRP interface.
Step 10	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

Redistributing BGP Routes into EIGRP

Perform this task to redistribute BGP routes into EIGRP.

Typically, EIGRP routes are redistributed into BGP with extended community information appended to the route. BGP carries the route over the VPN backbone with the EIGRP-specific information encoded in the BGP extended community attributes. After the peering customer site receives the route, EIGRP redistributes the BGP route then extracts the BGP extended community information and reconstructs the route as it appeared in the original customer site.

When redistributing BGP routes into EIGRP, the receiving provider edge (PE) EIGRP router looks for BGP extended community information. If the information is received, it is used to recreate the original EIGRP route. If the information is missing, EIGRP uses the configured default metric value.

If the metric values are not derived from the BGP extended community and a default metric is not configured, the route is not advertised to the customer edge (CE) router by the PE EIGRP. When BGP is redistributed into BGP, metrics may not be added to the BGP prefix as extended communities; for example, if EIGRP is not running on the other router. In this case, EIGRP is redistributed into BGP with a “no-metrics” option.

SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **vrf** *vrf-name*
4. **address-family** { **ipv4** }
5. **redistribute** {{ **bgp** | **connected** | **isis** | **ospf** | **ospfv3** | **rip** | **static** } [*as-number* | *instance-name*]} [**route-policy** *name*]
6. **route-policy** *route-policy-name* { **in** | **out** }
7. **default-metric** *bandwidth delay reliability loading mtu*
8. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
Step 3	**vrf** *vrf-name* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# router eigrp 100`	Configures a VRF instance.
Step 4	**address-family** { **ipv4** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf)# address-family ipv4`	Enters a VRF address family configuration mode.
Step 5	**redistribute** {{ **bgp** | **connected** | **isis** | **ospf** | **ospfv3** | **rip** | **static** } [*as-number* | *instance-name*]} [**route-policy** *name*] **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# redistribute bgp 100`	Injects routes from one routing domain into EIGRP.

	Command or Action	Purpose
Step 6	**route-policy** *route-policy-name* { **in** | **out** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# route-policy policy_A in`	Applies a routing policy to updates advertised to or received from an EIGRP neighbor.
Step 7	**default-metric** *bandwidth delay reliability loading mtu* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# default-metric 1000 100 250 100 1500`	Configures metrics for EIGRP.
Step 8	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

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**]
4. **log-neighbor-changes**
5. **log-neighbor-warnings**
6. Use the **commit** or **end** command.
7. **clear eigrp** [*as-number*] [**vrf** { *vrf* \| **all** }] [**ipv4**] **neighbors** [*ip-address* \| *type interface-path-id*]
8. **clear eigrp** [*as-number*] [**vrf** { *vrf* \| **all** }] [**ipv4**] **topology** [*prefix mask*] [*prefix / length*]
9. **show eigrp** [*as-number*] [**vrf** { *vrf* \| **all** }] [**ipv4**] **accounting**
10. **show eigrp** [*as-number*] [**vrf** { *vrf* \| **all** }][**ipv4**] **interfaces** [*type interface-path-id*] [**detail**]
11. **show eigrp** [*as-number*] [**vrf** { *vrf* \| **all** }] [**ipv4**] **neighbors** [**detail**] [*type interface-path-id* \| **static**]
12. **show protocols eigrp** [**vrf** *vrf-name*]

13. **show eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **topology** [*ip-address mask*] [**active** | **all-links** | **detail-links** | **pending** | **summary** | **zero-successors**]
14. **show eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **traffic**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
Step 3	**address-family** [**ipv4**] **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)#` **`address-family ipv4`**	Enters an address family configuration mode.

Step 4	**log-neighbor-changes**
	Example:
	`RP/0/RSP0/CPU0:router(config-eigrp-af)#`
	`log-neighbor-changes`
		Enables the logging of changes in EIGRP neighbor adjacencies.

Step 5	**log-neighbor-warnings**
	Example:
	`RP/0/RSP0/CPU0:router(config-eigrp-af)#`
	`log-neighbor-warnings`
		Enables the logging of EIGRP neighbor warning messages.

Step 6	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

	Command or Action	Purpose
Step 7	**clear eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **neighbors** [*ip-address* | *type interface-path-id*] **Example:** `RP/0/RSP0/CPU0:routerr# clear eigrp 20 neighbors GigabitEthernet 0/1/0/0`	Deletes EIGRP and VPN neighbor entries from the appropriate table.
Step 8	**clear eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **topology** [*prefix mask*] [*prefix / length*] **Example:** `RP/0/RSP0/CPU0:router# clear eigrp topology`	Deletes EIGRP and VRF topology entries from the appropriate tab.
Step 9	**show eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **accounting** **Example:** `RP/0/RSP0/CPU0:router# show eigrp vrf all accounting`	Displays prefix accounting information for EIGRP processes.
Step 10	**show eigrp** [*as-number*] [**vrf** { *vrf* | **all** }][**ipv4**] **interfaces** [*type interface-path-id*] [**detail**] **Example:** `RP/0/RSP0/CPU0:router# show eigrp interfaces detail`	Displays information about interfaces configured for EIGRP.
Step 11	**show eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **neighbors** [**detail**] [*type interface-path-id* | **static**] **Example:** `RP/0/RSP0/CPU0:router# show eigrp neighbors 20 detail static`	Displays the neighbors discovered by EIGRP.
Step 12	**show protocols eigrp** [**vrf** *vrf-name*] **Example:** `RP/0/RSP0/CPU0:router# show protocols eigrp`	Displays information about the EIGRP process configuration.
Step 13	**show eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **topology** [*ip-address mask*] [**active** | **all-links** | **detail-links** | **pending** | **summary** | **zero-successors**] **Example:** `RP/0/RSP0/CPU0:router# show eigrp topology 10.0.0.1 253.254.255.255 summary`	Displays entries in the EIGRP topology table.

	Command or Action	Purpose
Step 14	**show eigrp** [*as-number*] [**vrf** { *vrf* | **all** }] [**ipv4**] **traffic** **Example:** `RP/0/RSP0/CPU0:router# show eigrp traffic`	Displays the number of EIGRP packets sent and received.

Configuring an EIGRP Authentication Keychain

Perform the following tasks to configure an authentication keychain on EIGRP interfaces.

Configuring an Authentication Keychain for an IPv4/IPv6 Interface on a Default VRF

Perform this task to configure an authentication keychain for an IPv4/IPv6 interface on a default VRF.

SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **address-family** { **ipv4** | **ipv6** }
4. **interface** *type interface-path-id*
5. **authentication keychain** *keychain-name*
6. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
Step 3	**address-family** { **ipv4** | **ipv6** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# address-family ipv4`	Enters a VRF address family configuration mode.

	Command or Action	Purpose
Step 4	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af)# interface gigabitEthernet 0/1/5/0`	Configures the interface on which EIGRP the routing protocol runs.
Step 5	**authentication keychain** *keychain-name* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-af-if)# authentication keychain`	Authenticates all EIGRP protocol traffic on the interface, based on the MD5 algorithm.
Step 6	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

Configuring an Authentication Keychain for an IPv4/IPv6 Interface on a Nondefault VRF

Perform this task to configure an authentication keychain for an IPv4/IPv6 interface on a nondefault VRF.

SUMMARY STEPS

1. **configure**
2. **router eigrp** *as-number*
3. **vrf** *vrf-name*
4. **address-family** { **ipv4** | **ipv6** }
5. **interface** *type interface-path-id*
6. **authentication keychain** *keychain-name*
7. Use the **commit** or **end** command.

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:**	Enters global configuration mode.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:router# configure`	
Step 2	**router eigrp** *as-number* **Example:** `RP/0/RSP0/CPU0:router(config)# router eigrp 100`	Specifies the autonomous system number of the routing process to configure an EIGRP routing process.
Step 3	**vrf** *vrf-name* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp)# vrf vrf1`	Creates a VRF instance and enters VRF configuration mode.
Step 4	**address-family** { **ipv4** | **ipv6** } **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf)# address-family ipv4`	Enters a VRF address family configuration mode.
Step 5	**interface** *type interface-path-id* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af)# interface gigabitEthernet 0/1/5/0`	Configures the interface on which EIGRP runs.
Step 6	**authentication keychain** *keychain-name* **Example:** `RP/0/RSP0/CPU0:router(config-eigrp-vrf-af-if)# authentication keychain`	Authenticates all EIGRP protocol traffic on the interface, based on the MD5 algorithm.
Step 7	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** —Exits the configuration session without committing the configuration changes. • **Cancel** —Remains in the configuration session, without committing the configuration changes.

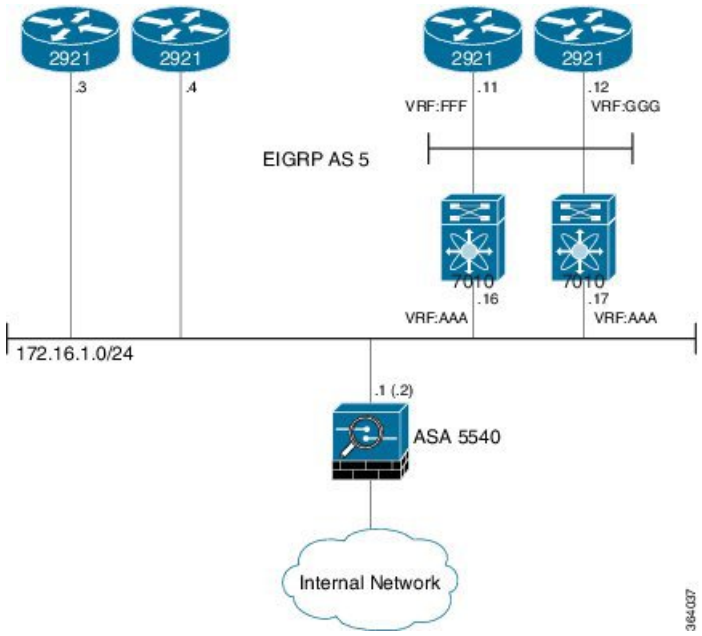
Configuring unicast neighbors

EIGRP typically broadcasts or multicasts routing updates. For security reasons, you can opt to configure static neighbors in the EIGRP routing process, forcing EIGRP to communicate to specified neighbors using unicast.

When you specify a static neighbor relationship over a particular interface, EIGRP disables the processing of multicast EIGRP packets on the specified interface. This ensures that EIGRP does not send nor process received multicast EIGRP traffic on an interface which has a static neighbor defined under the EIGRP routing process.

In cases where the neighbors are not adjacent, normal EIGRP peering mechanisms cannot be used to exchange EIGRP information. In order to support this type of network, EIGRP provides the neighbor command, which allows remote neighbors to be configured and sessions established though unicast packet transmission. However, as the number of forwarders needing to exchange EIGRP information over the networking cloud increases, unicast EIGRP neighbor definitions may become cumbersome to manage. Each neighbor must be manually configured, resulting in increased operational costs. To better accommodate deployment of these topologies, ease configuration management, and reduce operational costs, the Dynamic Neighbors feature provides support for the dynamic discovery of remote unicast (referred to as “remote neighbors”). Remote neighbor support allows EIGRP peering to one or more remote neighbors, which may not be known at the time the device is configured, thus reducing configuration management.

In the topology illustrated below, ASA behaves as a hub and the other routers (2921s, 7010s) act as spokes. The 2921's and 7010's must not peer with each other, and there must never be a time where a packet (data traffic) is routed in this path: ASA > 2921.3 > 2921.4. To support this type of network, EIGRP allows you to configure static neighbors and establish sessions using unicast packet transmission. Thus, in this topology, 2921s and 7010s peer with ASA using neighbor command and ASA is configured to dynamically discover remote neighbors.



Remote Neighbor Session Policy

When using remote unicast-listen or remote multicast-group neighbor configurations, EIGRP neighbor IP addresses are not predefined, and neighbors may be many hops away. A device with this configuration could peer with any device that sends a valid HELLO packet. Because of security considerations, this open aspect requires policy capabilities to limit peering to valid devices and to restrict the number of neighbors in order to limit resource consumption. This capability is accomplished using the following manually configured parameters, and takes effect immediately.

- **Neighbor Filter List**

The optional allow-list keyword, available in the remote-neighbors command, enables you to use an access list (access control list) to specify the remote IP addresses from which EIGRP neighbor connections may be accepted. If you do not use the allow-list keyword, then all IP addresses (permit any) will be accepted. The access control list (ACL) defines a range of IPv4 or IPv6 IP addresses with the following conditions:

- Any neighbor that has a source IP address that matches an IP address in the access list will be allowed (or denied) based on the user configuration.
- If the allow-list keyword is not specified, any IP address will be permitted (permit any).
- The allow-list keyword is supported only for remote multicast-group and unicast-listen neighbors. It is not available for static, remote static, or local neighbors.
- Incoming EIGRP packets that do not match the specified access list will be rejected.

- **Maximum Remote Neighbors**

  The optional max-neighbors keyword, available in the remote-neighbors command, enables you to specify a maximum number of remote neighbors that EIGRP can create using the remote neighbor configurations. When the maximum number of remote neighbors has been created for a configuration, EIGRP rejects all subsequent connection attempts for that configuration. This option helps to protect against denial-of-service attacks that attempt to create many remote neighbors in an attempt to overwhelm device resources. The max-neighbors configuration option has the following conditions:

  - This option is supported only for remote multicast-group or unicast-listen neighbors. It is not available for local, static, or remote static neighbors.
  - There is no default maximum. If you do not specify a maximum number of remote neighbors, the number of remote neighbors is limited only by available memory and bandwidth.
  - Reducing the maximum number of remote neighbors to less than the current number of sessions will result in the neighbors (in no specific order) being dropped until the count reaches the new limit.

- **Configuration Changes for the Neighbor Filter List and Maximum Number of Remote Neighbors**

  When the allow-list or max-neighbors configurations are changed, any existing remote EIGRP sessions that are no longer allowed by the new configuration will be removed automatically and immediately. Pre-existing neighbors that are still allowed by the new configuration will not be affected.

Understanding Neighbor Terms

The following terms are used when describing neighbor types:

- **local neighbor:** A neighbor that is adjacent on a shared subnet (or common subnet) and uses a link-local multicast address for packet exchange. This is the default type of neighbor in EIGRP.
- **static Neighbor:** Any neighbor that uses unicast to communicate, is one hop away, is on a common subnet, and whose IP address has been specified using the neighbor ip-address command.
- **remote neighbor:** Any neighbor that is multiple hops away, including Remote Static Neighbors.
- **remote group:** Any neighbor that is multiple hops away, does not have its address manually configured with the neighbor command and uses the multicast group address for packet exchange.
- **remote static neighbor:** Any neighbor that uses unicast to communicate, is multiple hops away, and whose IP address has been specified using the neighbor ip-address command.
- **remote unicast-listen (or simply unicast-listen):** Any neighbor that uses unicast to communicate, is multiple hops away, and whose IP address has not been configured using the neighbor ip-address command.

- **remote dnyamic:** Any neighbor that is multiple hops away and whose address has not been configured with the neighbor ip-address command, that is, a remote multicast-group or remote unicast-listen neighbor, but not a remote static neighbor.

Remote Unicast-Listen (Point-to-Point) Neighbors

For configurations in which multiple remote neighbors peer with a single hub (point-to-point), the hub can be configured for remote unicast-listen peering using the remote-neighbors command to allow the remote neighbors to peer with the hub without having to manually configure the remote neighbor IP addresses on the hub. When configured with this command, the hub device:

- Uses its interface IP address as the source IP address for any unicast transmissions. This IP address must be routable.
- Requires neighbors that peer with the hub to be configured using the neighbor ip-address loopback loopback-interface-number remote maximum-hops command where ip-address is the unicast address of the local device interface.
- Listens for unicast HELLO packets on the interface specified in the remote-neighbor command.
- Accepts a unicast HELLO packet if it is in the IP address range configured using the allow-list keyword, or any unicast HELLO packet if an allow list is not defined.
- Rejects multicast HELLO packets from any neighbor that is also sending unicast HELLO packets and is permitted by the unicast allow list (or all neighbors if an allow list is not defined).
- Begins normal neighbor establishment using the IP addresses of the remote neighbors for packet transmission once the neighbor relationship is established.
- When remote-neighbor command is configured on an interface, the router will only start sending HELLOs on that interface if it has atleast one neighbor and only to those neighbors from which it has received HELLOs.
- On an interface if dynamic neighbors already exist and remote-neighbor unicast- listen is configured, then the existing neighbor relationships will be torn down and only unicast-neighbor relationships will be allowed there after.

Restrictions for remote neighbors

A single unicast address can only be configured to a single remote static neighbor for a given address-family. You cannot configure a second remote static neighbor using the same unicast address, on a different interface. EIGRP configuration of remote neighbors under different address families is unrestricted.

A single interface can be configured under a single address family with a single unicast-listen remote-neighbors command and with any number of static and remote static neighbors (each using a different unicast address).

Inheritance and precedence of the remote neighbor configurations

Static neighbors configured with the neighbor <*address*> or neighbor <*address*> remote commands take precedence over the remote neighbors created as a result of the remote-neighbors command. If the remote address of an incoming unicast EIGRP connection matches both a static neighbor and the remote unicast-listen neighbor access list, the static neighbor is used and no remote unicast-listen neighbor is created. If you configure a new static neighbor while a remote neighbor for the same remote address already exists, EIGRP automatically removes the remote unicast-listen neighbor.

How to configure remote unicast neighbors

When configuring an EIGRP unicast neighbor, the neighbor statement is required on both ends (hub and spoke) of the neighbor relationship in the EIGRP routing process that operate in the same autonomous system.

Before you begin

Ensure that when using unicast-listen mode, IP connectivity (reachability) exists between devices that need to do remote peering.

SUMMARY STEPS

1. **configure**
2. **router eigrp** `AS Number`
3. **address-family { ipv4 | ipv6 }**
4. **interface**`type interface-path-id`
5. **remote-neighbor unicast-listen**{[**allow-list**route policy name][**max-neighbors**maximum remote peers]}
6. Use the **commit** or **end** command.
7. **sh run router eigrp**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:router# configure`	Enters global configuration mode.
Step 2	**router eigrp** `AS Number` **Example:** `RP/0/RSP0/CPU0:HUB(config)#router eigrp 100`	Enables an EIGRP router instance.
Step 3	**address-family { ipv4 | ipv6 }** **Example:** `RP/0/RSP0/CPU0:HUB(config-eigrp)#address-family ipv6`	Specifies either an IPv4 or IPv6 address family unicast and enters address family configuration submode.
Step 4	**interface**`type interface-path-id` **Example:** `RP/0/RSP0/CPU0:HUB(config-eigrp-af)#int g0/0/0/3`	Configures an interface and enters the interface configuration mode.
Step 5	**remote-neighbor unicast-listen**{[**allow-list**route policy name][**max-neighbors**maximum remote peers]} **Example:** `RP/0/RSP0/CPU0:HUB(config-eigrp-af-if)# remote-neighbor unicast-listen`	Configures a EGRP process that enables remote neighbors to accept inbound connections from any remote IP address. • **allow-list** keyword to use an access list (access control list) to specify the remote IP addresses from which EIGRP neighbor connections may be accepted. If you do not use the allow list keyword, all IP addresses will be accepted. • **max-neighbors** keyword to specify the maximum number of remote neighbors. If you do not specify a

	Command or Action	Purpose
		number, the maximum number of remote neighbors is limited only by available memory and bandwidth.
Step 6	Use the **commit** or **end** command.	**commit** —Saves the configuration changes and remains within the configuration session. **end** —Prompts user to take one of these actions: • **Yes** — Saves configuration changes and exits the configuration session. • **No** — Exits the configuration session without committing the configuration changes. • **Cancel** — Remains in the configuration mode, without committing the configuration changes.
Step 7	**sh run router eigrp**	

Configuring EIGRP remote unicast neighbors

The following examples show how to configure both devices (hub and spoke) involved in the neighbor relationship.

```
RP/0/RSP0/CPU0:HUB(config)#router eigrp 100
RP/0/RSP0/CPU0:HUB(config-eigrp)#address-family ipv4
RP/0/RSP0/CPU0:HUB(config-eigrp-af)#int g0/0/0/3
RP/0/RSP0/CPU0:HUB(config-eigrp-af-if)#exit
RP/0/RSP0/CPU0:HUB(config-eigrp-af)#interface gigabitEthernet 0/0/0/3
RP/0/RSP0/CPU0:HUB(config-eigrp-af-if)#remote-neighbor unicast-listen
RP/0/RSP0/CPU0:HUB(config-eigrp-af-if)#commit

RP/0/RSP0/CPU0:spoke(config)#router eigrp 100
RP/0/RSP0/CPU0:spoke(config-eigrp)#address-family ipv4
RP/0/RSP0/CPU0:spoke(config-eigrp-af)#interface g0/0/0/3
RP/0/RSP0/CPU0:spoke(config-eigrp-af-if)#neighbor 21.21.21.1 remote 10
RP/0/RSP0/CPU0:spoke(config-eigrp-af-if)#commit

RP/0/RSP0/CPU0:spoke#sh run router eigrp
Fri Aug  8 08:47:48.556 UTC
router eigrp 100
address-family ipv4
interface GigabitEthernet0/0/0/3
neighbor 21.21.21.1  remote 10! !!
```

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
      !
    !
  !
```

Configuring an EIGRP PE-CE Configuration with Prefix-Limits: Example

The following example shows how to configure EIGRP to operate as a PE-CE protocol on a PE router. The configuration is under VRF CUSTOMER_1. A maximum prefix is typically configured to ensure that one set of customer routes do not overwhelm the EIGRP process.

```
router eigrp 500
  vrf CUSTOMER_1
    address-family ipv4
      timers nsf route-hold 300
```

```
    router-id 172.16.6.11
    maximum-prefix 450 70
    default-metric 200000 10000 195 10 1500
    log-neighbor-changes
    log-neighbor-warnings
    redistribute maximum-prefix 350 70
    redistribute bgp 1.65500 route-policy SITE_1_POLICY
    interface GigabitEthernet 0/4/0/5
    neighbor 10.22.1.1
    !
  !
!
```

Configuring an EIGRP Authentication Keychain: Example

The following example shows how to configure an authentication keychain for an IPv4 interface on a nondefault VRF:

```
config
router eigrp 100
vrf vrf1
address-family ipv4
interface POS 0/1/0/0
authentication keychain key1
```

The following example shows how to configure an authentication keychain for an IPv6 interface on a default VRF:

```
config
router eigrp 100
address-family ipv6
interface POS 0/1/0/0
authentication keychain key2
```

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	*Routing Command Reference for Cisco ASR 9000 Series Routers*
MPLS VPN support for EIGRP feature information	*Implementing MPLS Layer 3 VPNs* module and *Implementing MPLS Layer 2 VPNs* module in *MPLS Configuration Guide for Cisco ASR 9000 Series Routers*

Related Topic	Document Title
Site of Origin (SoO) support for EIGRP feature information	*Implementing MPLS Traffic Engineering on* Cisco ASR 9000 Series Router module in *MPLS Configuration Guide for Cisco ASR 9000 Series Routers*
MIB Reference	*Cisco ASR 9000 Series Aggregation Services Router MIB Specification Guide.*

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: https://mibs.cloudapps.cisco.com/ITDIT/MIBS/servlet/index

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.	http://www.cisco.com/techsupport