key chain

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

key chain *name-of-chain*

no key chain *name-of-chain*

Syntax Description

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

Defaults

No key chain exists.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

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

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

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

Examples

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

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

```
key 2
key-string birch
accept-lifetime 14:30:00 Jan 25 1996 duration 7200
send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

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

key

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

key *key-id*

no key *key-id*

Syntax Description

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

Defaults

No key exists on the key chain.

Command Modes

key-chain configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

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

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

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

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

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

Examples

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

```
interface ethernet 0
 ip rip authentication key-chain trees
 ip rip authentication mode md5
!
```

```
router rip
 network 172.19.0.0
 version 2
!
key chain trees
 key 1
 key-string chestnut
 accept-lifetime 13:30:00 Jan 25 1996 duration 7200
 send-lifetime 14:00:00 Jan 25 1996 duration 3600
 key 2
 key-string birch
 accept-lifetime 14:30:00 Jan 25 1996 duration 7200
 send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

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

key-string (authentication)

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

key-string *text*

no key-string [*text*]

Syntax Description

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

Defaults

No key exists.

Command Modes

Key chain key configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

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

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

Examples

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

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

```
key-string birch
accept-lifetime 14:30:00 Jan 25 1996 duration 7200
send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

Related Commands

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

limit retransmissions

To change or remove the limit in the number of retransmissions of database exchange and update packets for both demand and non-demand circuits, use the **limit retransmissions** command in router configuration mode. To reset the maximum number of retransmissions back to the default value of 24, use the **no** form of this command.

limit retransmissions {[**dc** {*max-number* | **disable**}] [**non-dc** {*max-number* | **disable**}]}

no limit transmissions [**dc** | **non-dc**]

Syntax Description

dc	Demand circuit retransmissions.
max-number	Maximum number of retransmissions. Range from 1 to 255.
non-dc	Nondemand circuit retransmissions.
disable	Disables or removes the limit to the number of retransmissions.

Defaults

Maximum number of retransmissions is 24.

Command Modes

Router configuration

Command History

Release	Modification
12.2(11)T	This command was introduced.

Usage Guidelines

Cisco IOS Release 12.2(4)T added a limit to the number of retransmissions of database exchange and update packets for both demand and nondemand circuits. The retransmission of these packets stops once this retry limit is reached, thus preventing unnecessary use of the link in continual retransmission of the packets if, for some reason, a neighbor is not responding during adjacency forming.

The limit for both demand circuit and nondemand circuit retransmissions is 24.

The **limit-retransmissions** command allows you to either remove (disable) the limit or change the maximum number of retransmissions to be a number from 1 to 255. The configuration of this command provides for backward compatibility for previous or other releases of Cisco IOS Software or other routers that do not have this feature.

Note The limit to the number of retransmissions does not apply for update packets on nonbroadcast multiaccess (NBMA) point-to-multipoint direct circuits. In this situation, the dead timer is used to end communication with nonresponding neighbors and thus stop the retransmissions.

Examples

The following example shows how to set the maximum number of demand circuit retransmissions to 10:

```
limit retransmissions dc 10
```

The following example shows how to remove the limit for the number of demand circuit retransmissions:

```
limit retransmissions dc disable
```

The following example shows how to set the maximum number of demand circuit retransmissions to 10 and to set the maximum number of nondemand circuit retransmissions to 20:

```
limit retransmissions dc 10 non-dc 20
```

The following example shows how to set the maximum number of demand circuit retransmissions to 10, and to remove the limit for the number of nondemand circuit retransmissions:

```
limit retransmissions dc 10 non-dc disable
```

The following example shows how to reset both the demand circuit and nondemand circuit maximum number of retransmissions back to the default of 24:

```
no limit retransmissions
```

Related Commands

Command	Description
router ospf	Configures an OSPF routing process.

log-adjacency-changes

To configure the router to send a syslog message when an OSPF neighbor goes up or down, use the **log-adjacency-changes** command in router configuration mode. To turn off this function, use the **no** form of this command.

log-adjacency-changes [**detail**]

no log-adjacency-changes [**detail**]

Syntax Description

detail	(Optional) Sends a syslog message for each state change, not just when a neighbor goes up or down.

Defaults

Enabled

Command Modes

Router configuration

Command History

Release	Modification
11.2	This command was introduced as "**ospf log-adjacency-changes**".
12.1	The **ospf** keyword was omitted and the **detail** keyword was added.

Usage Guidelines

This command allows you to know about OSPF neighbors going up or down without turning on the **debug ip ospf adjacency** command. The **log-adjacency-changes** command provides a higher level view of those changes of the peer relationship with less output. This command is on by default but only up/down (full/down) events are reported, unless the **detail** keyword is also configured.

Examples

The following example configures the router to send a syslog message when an OSPF neighbor state changes:

```
log-adjacency-changes detail
```

lsp-gen-interval (IS-IS)

To customize IS-IS throttling of LSP generation, use the **lsp-gen-interval** command in router configuration mode. To restore default values, use the **no** form of this command.

lsp-gen-interval [**level-1** | **level-2**] *lsp-max-wait* [*lsp-initial-wait lsp-second-wait*]

no lsp-gen-interval

Syntax Description

level-1	(Optional) Apply intervals to Level-1 areas only.
level-2	(Optional) Apply intervals to Level-2 areas only.
lsp-max-wait	Indicates the maximum interval (in seconds) between two consecutive ocurrences of an LSP being generated. The range is 1 to 120 seconds. The default is 5 seconds.
lsp-initial-wait	(Optional) Indicates the initial LSP generation delay (in milliseconds). The range is 1 to 120000 milliseconds. The default is 50 milliseconds.
lsp-second-wait	(Optional) Indicates the hold time between the first and second LSP generation (in milliseconds). The range is 1 to 120000 milliseconds. The default is 5000 milliseconds (5 seconds).

Defaults

lsp-max-wait: 5 seconds
lsp-initial-wait: 50 milliseconds
lsp-second-wait: 5000 milliseconds

Command Modes

Router configuration

Command History

Release	Modification
12.1	This command was introduced.

Usage Guidelines

The following description will help you determine whether to change the default values of this command:

- The *lsp-initial-wait* argument indicates the initial wait time (in milliseconds) before generating the first LSP.
- The third argument indicates the amount of time to wait (in milliseconds) between the first and second LSP generation.
- Each subsequent wait interval is twice as long as the previous one until the wait interval reaches the *lsp-max-wait* interval specified, so this value causes the throttling or slowing down of the LSP generation after the initial and second intervals. Once this interval is reached, the wait interval continues at this interval until the network calms down.
- After the network calms down and there are no triggers for 2 times the *lsp-max-wait* interval, fast behavior is restored (the initial wait time).

Notice that the **lsp-gen-interval** command controls the delay between LSPs being *generated*, as opposed to the following related commands:

- The **isis lsp-interval** command sets the delay (in milliseconds) between successive LSPs being *transmitted* (including LSPs generated by another system and forwarded by the local system).
- The **isis retransmit-interval** command sets the amount of time (in seconds) between retransmissions *of the same LSP* on a point-to-point link.
- The **isis retransmit-throttle-interval** command sets the minimum delay (in milliseconds) between retransmitted LSPs on a point-to-point interface.

These commands can be used in combination to control the rate of LSP packets being generated, transmitted, and retransmitted.

Examples

The following example configures intervals for SPF calculations, PRC, and LSP generation:

```
router isis
 spf-interval 5 10 20
 prc-interval 5 10 20
 lsp-gen-interval 2 50 100
```

Related Commands

Command	Description
isis lsp-interval	Sets the time delay between successive IS-IS LSP transmissions.
isis retransmit-interval	Sets the amount of time between retransmission of each IS-IS LSP on a point-to-point link.
isis retransmit-throttle-interval	Sets the minimum delay between retransmissions on each LSP on a point-to-point interface.

lsp-refresh-interval (IS-IS)

To set the link-state packet (LSP) refresh interval, use the **lsp-refresh-interval** command in router configuration mode. To restore the default refresh interval, use the **no** form of this command.

lsp-refresh-interval *seconds*

no **lsp-refresh-interval**

Syntax Description

seconds	Interval (in seconds) at which LSPs are refreshed.The range is 1 to 65535 seconds. The default value is 900 seconds (15 minutes).

Defaults

900 seconds (15 minutes)

Command Modes

Router configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

The refresh interval determines the rate at which Cisco IOS software periodically transmits in LSPs the route topology information that it originates. This is done to keep the database information from becoming too old.

LSPs must be periodically refreshed before their lifetimes expire. The value set for the **lsp-refresh-interval** command should be less than the value set for the **max-lsp-lifetime** command; otherwise, LSPs will time out before they are refreshed. If you misconfigure the LSP lifetime to be too low compared to the LSP refresh interval, the software will reduce the LSP refresh interval to prevent the LSPs from timing out.

Reducing the refresh interval reduces the amount of time that undetected link state database corruption can persist at the cost of increased link utilization. (This is an extremely unlikely event, however, because there are other safeguards against corruption.) Increasing the interval reduces the link utilization caused by the flooding of refreshed packets (although this utilization is very small).

Examples

The following example configures the IS-IS LSP refresh interval to be 1080 seconds (18 minutes):

```
router isis
 lsp-refresh-interval 1080
```

Related Commands

Command	Description
max-lsp-lifetime (IS-IS)	Sets the maximum time that link-state packets (LSPs) can remain in a router's database without being refreshed.

match as-path

To match a BGP autonomous system path access list, use the **match as-path** command in route-map configuration mode. To remove a path list entry, use the **no** form of this command.

match as-path *path-list-number*

no match as-path *path-list-number*

Syntax Description

path-list-number	Autonomous system path access list. An integer from 1 to 199.

Defaults

No path lists are defined.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The values set by the **match as-path** and **set weight** commands override global values. For example, the weights assigned with the **match as-path** and **set weight** route-map configuration commands override the weight assigned using the **neighbor weight** command.

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

Examples

The following example sets the autonomous system path to match BGP autonomous system path access list 20:

```
route-map IGP2BGP
 match as-path 20
```

Related Commands

Command	Description
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.

Command	Description
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
neighbor weight	Assigns weight to a neighbor connection.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
set as-path	Modifies an autonomous system path for BGP routes.
set automatic-tag	Automatically computes the tag value in a route map configuration.
set community	Sets the BGP communities attribute.
set level (IP)	Indicates where to import routes.
set local-preference	Specifies a preference value for the autonomous system path.
set metric (BGP, OSPF, RIP)	Sets the metric value for a routing protocol.
set metric-type	Sets the metric type for the destination routing protocol.
set next-hop	Specifies the address of the next hop.
set origin (BGP)	Sets the BGP origin code.
set tag (IP)	Sets the value of the destination routing protocol.
set weight	Specifies the BGP weight for the routing table.

match community

To match a Border Gateway Protocol (BGP) community, use the **match community** command in route-map configuration mode. To remove the **match community** command from the configuration file and restore the system to its default condition where the software removes the BGP community list entry, use the **no** form of this command.

match community {*standard-list-number* | *expanded-list-number* | *community-list-name* [**exact**]}

no match community {*standard-list-number* | *expanded-list-number* | *community-list-name* [**exact**]}

Syntax Description

standard-list-number	Specifies a standard community list number from 1 to 99 that identifies one or more permit or deny groups of communities.
expanded-list-number	Specifies an expanded community list number from 100 to 500 that identifies one or more permit or deny groups of communities.
community-list-name	The community list name.
exact	(Optional) Indicates that an exact match is required. All of the communities and only those communities specified must be present.

Defaults

No community list is matched by the route map.

Command Modes

Route-map configuration

Command History

Release	Modification
12.1	This command was introduced.
12.1(9)E	Named community list support was integrated into Cisco IOS Release 12.1(9)E.
12.2(8)T	Named community list support was integrated into Cisco IOS Release 12.2(8)T.
12.0(22)S	The maximum number of expanded extended community list numbers was changed from 199 to 500 in Cisco IOS Release 12.0(22)S.
12.2(15)T	The maximum number of expanded extended community list numbers was changed from 199 to 500 in Cisco IOS Release 12.2(15)T.

Usage Guidelines

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

Matching based on community list number is one of the types of **match** commands applicable to BGP.

Examples

The following example shows that the routes matching community list 1 will have the weight set to 100. Any route that has community 109 will have the weight set to 100.

```
Router(config)# ip community-list 1 permit 109
Router(config)# !
Router(config)# route-map set_weight
Router(config-route-map)#  match community 1
Router(config-route-map)# set weight 100
```

The following example shows that the routes matching community list 1 will have the weight set to 200. Any route that has community 109 alone will have the weight set to 200.

```
Router(config)# ip community-list 1 permit 109
Router(config)# !
Router(config)# route-map set_weight
Router(config-route-map)# match community 1 exact
Router(config-route-map)# set weight 200
```

In the following example, the routes that match community list LIST_NAME will have the weight set to 100. Any route that has community 101 alone will have the weight set to 100.

```
Router(config)# ip community-list 1 permit 101
Router(config)# !
Router(config)# route-map set_weight
Router(config-route-map)# match community LIST_NAME
Router(config-route-map)# set weight 100
```

The following example shows that the routes that match expanded community list 500. Any route that has extended community 1 will have the weight set to 150.

```
Router(config)# ip community-list 500 permit [0-9]*
Router(config)# !
Router(config)# route-map MAP_NAME permit 10
Router(config-route-map)# match extcommunity 500
Router(config-route-map)# set weight 150
```

Related Commands

Command	Description
ip community-list	Creates a community list for BGP and controls access to it.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another.
set weight	Specifies the BGP weight for the routing table.

match extcommunity

To match Border Gateway Protocol (BGP) extended community list attributes, use the **match extcommunity** command in route-map configuration mode. To remove the **match extcommunity** command from the configuration file and remove the BGP extended community list attribute entry, use the **no** form of this command.

match extcommunity *standard-list-number expanded-list-number*

no match extcommunity *standard-list-number expanded-list-number*

Syntax Description

standard-list-number	A standard extended community list number from 1 to 99 that identifies one or more permit or deny groups of extended community attributes.
expanded-list-number	An expanded extended community list number from 100 to 500 that identifies one or more permit or deny groups of extended community attributes.

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
12.1	This command was introduced.
12.0(22)S	The maximum number of expanded extended community list numbers was changed from 199 to 500 in Cisco IOS Release 12.0(22)S.
12.2(15)T	The maximum number of expanded extended community list numbers was changed from 199 to 500 in Cisco IOS Release 12.2(15)T.

Usage Guidelines

Extended community attributes are used to configure, filter, and identify routes for virtual routing and forwarding instances (VRFs) and Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs).

The **match extcommunity** command is used to configure match clauses that use extended community attributes in route maps. The range of numbers that can be configured with the **match extcommunity** command is from 1 to500. All of the standard rules of match and set clauses apply to the configuration of extended community attributes.

Examples

The following example shows that the routes that match extended community list 500 will have the weight set to 100. Any route that has extended community 1 will have the weight set to 100.

```
Router(config)# ip extcommunity-list 500 rt 100:2
Router(config)# !
Router(config)# route-map MAP_NAME permit 10
```

```
Router(config-route-map)# match extcommunity 1
Router(config-route-map)# set weight 100
```

Related Commands

Command	Description
ip extcommunity-list	Creates an extended community list for BGP and controls access to it.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another.
set extcommunity	Sets BGP extended community attributes.
set weight	Specifies the BGP weight for the routing table.
show ip extcommunity-list	Displays routes that are permitted by the extended community list.
show route-map	Displays configured route maps.

match interface (IP)

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

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

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

Syntax Description

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

Defaults

No match interfaces are defined.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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

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

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

Examples

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

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

Related Commands

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

match ip address

To distribute any routes that have a destination network number address that is permitted by a standard access list, an extended access list, or a prefix list, or to perform policy routing on packets, use the **match ip address** command in route-map configuration mode. To remove the **match ip address** entry, use the **no** form of this command.

match ip address {*access-list-number* [*access-list-number...* | *access-list-name...*] | *access-list-name* [*access-list-number...*| *access-list-name*] | **prefix-list** *prefix-list-name* [*prefix-list-name...*]}

no match ip address {*access-list-number* [*access-list-number...* | *access-list-name...*] | *access-list-name* [*access-list-number...*| *access-list-name*] | **prefix-list** *prefix-list-name* [*prefix-list-name...*]}

Syntax Description

access-list-number...	Number of a standard or extended access list. It can be an integer from 1 to 199. The ellipsis indicates that multiple values can be entered.
access-list-name...	Name of a standard or extended access list. It can be an integer from 1 to 199. The ellipsis indicates that multiple values can be entered.
prefix-list	Distributes routes based on a prefix list.
prefix-list-name...	Name of a specific prefix list. The ellipsis indicates that multiple values can be entered.

Defaults

No access list numbers or prefix lists are specified.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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

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

Redistribution

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

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

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

Policy Routing

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

Examples

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

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

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

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

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

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

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

Related Commands

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

match ip next-hop

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

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

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

Syntax Description

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

Defaults

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

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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

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

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

Examples

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

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

Related Commands

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

match ip route-source

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

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

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

Syntax Description

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

Defaults

No filtering on route source.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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

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

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

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

Examples

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

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

Related Commands

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

match length

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

match length *minimum-length maximum-length*

no match length *minimum-length maximum-length*

Syntax Description

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

Defaults

No policy routing on the length of a packet.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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

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

Examples

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

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

Related Commands

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

match metric (IP)

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

match metric *metric-value*

no match metric *metric-value*

Syntax Description

metric-value	Route metric, which can be an EIGRP five-part metric. It is a metric value from 0 to 4294967295.

Defaults

No filtering on a metric value.

Command Modes

Route-map configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

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

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

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

Examples

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

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

Related Commands

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

match policy-list

To configure a route map to evaluate and process a Border Gateway Protocol (BGP) policy list in a route map, use the **match policy-list command in** route-map configuration mode. To remove a path list entry, use the **no** form of this command.

match policy-list *policy-list-name*

no match policy-list *policy-list-name*

Syntax Description

policy-list-name	Name of the policy list to evaluate and process within the route map.

Defaults

This command is not enabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
12.0(22)S	This command was introduced.
12.2(15)T	This command was integrated into 12.2(15)T.

Usage Guidelines

When a policy list is referenced within a route map, all the match statements within the policy list are evaluated and processed.

Two or more policy lists can be configured with a route map. Policy lists can be configured within a route map to be evaluated with AND semantics or OR semantics.

Policy lists can also coexist with any other preexisting match and set statements that are configured within the same route map but outside of the policy lists.

When multiple policy lists perform matching within a route map entry, all policy lists match on the incoming attribute only.

Examples

The following configuration example creates a route map that references policy lists and separate match and set clauses in the same configuration:

```
Router(config)# route-map MAP-NAME-1 10
Router(config-route-map)# match ip-address 1
Router(config-route-map)# match policy-list POLICY-LIST-NAME-1
Router(config-route-map)# set community 10:1
Router(config-route-map)# set local-preference 140
Router(config-route-map)# end
```

The following configuration example creates a route map that references policy lists and separate match and set clauses in the same configuration. This example processes the policy lists named POLICY-LIST-NAME-2 and POLICY-LIST-NAME-3 with OR semantics. A match is required from only one of the policy lists.

```
Router(config)# route-map MAP-NAME-2 10
Router(config-route-map)# match policy-list POLICY-LIST-NAME-2 POLICY-LIST-NAME-3
Router(config-route-map)# set community 10:1
Router(config-route-map)# set local-preference 140
Router(config-route-map)# end
```

Related Commands

Command	Description
ip policy-list	Creates a BGP policy list.
match community	Matches a BGP community.
match interface (IP)	Distributes routes that have their next hop out one of the interfaces specified.
match ip address	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
match ip next-hop	Redistributes any routes that have a next hop router address passed by one of the access lists specified.
match ip route-source	Redistributes routes that have been advertised by routers and access servers at the address specified by the access lists.
match metric (IP)	Redistributes routes with the metric specified.
match as-path	References a policy list within a route map for evaluation and processing.
match route-type (IP)	Redistributes routes of the specified type.
match tag	Redistributes routes in the routing table that match the specified tags.
neighbor weight	Assigns weight to a neighbor connection.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.

match route-type (IP)

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

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

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

Syntax Description

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

Defaults

This command is disabled by default.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.
11.2	The **local** and **external** [**type-1** | **type-2**] keywords were added.

Usage Guidelines

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

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

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

Examples

The following example redistributes internal routes:

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

Related Commands

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

match tag

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

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

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

Syntax Description

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

Defaults

No match tag values are defined.

Command Modes

Route-map configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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

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

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

Examples

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

```
route-map name
 match tag 5
```

Related Commands

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

maximum-paths

To configure the maximum number of parallel routes that an IP routing protocol will install into the routing table, use the **maximum-paths** command in router configuration or address family configuration mode. To restore the default value, use the **no** form of this command.

maximum-paths *number* [**import** *number*]| **import** *number*

no maximum-paths *number* | **import** *number*

Syntax Description

number	Specifies the number of routes to install to the routing table. See the usage guidelines for the number of paths that can be configured with this argument.
import *number*	(Optional) Specifies the number of redundant paths that can be configured as back up multipaths for a VRF. This keyword can only be configured under a VRF in address family configuration mode. **Note** We recommend that this feature is enabled only where needed and that the number of import paths be kept to the minimum (Typically, not more than two paths). For more information, see the related note in the usage guidelines of this command reference page.

Defaults

Border Gateway Protocol (BGP) by default will install only one best path in the routing table. The default for all other IP routing protocols is four paths.

Command Modes

Router configuration
Address family configuration

Command History

Release	Modification
11.2	This command was introduced.
12.0(25)S	The **import** keyword was introduced.
12.2(13)T	The **import** keyword was integrated into Cisco IOS Release 12.2(13)T.
12.2(14)S	The **import** keyword was integrated into Cisco IOS Release 12.2(14)S.

Usage Guidelines

The **maximum-paths** command is used to set the number of parallel (equal-cost) routes that BGP will install in the routing table to configure multipath loadsharing. The number of paths that can be configured is determined by the version of Cisco IOS software. The following list shows current limits:

- Cisco IOS Release 12.0S based software: 8 paths
- Cisco IOS Release 12.3T based software: 16 paths
- Cisco IOS Release 12.2S based software: 32 paths

The **maximum-paths** command cannot be configured with the **maximum-paths eibgp** command for the same BGP routing process.

Configuring VRF Import Paths

A VRF will import only one path (best path) per prefix from the source VRF table, unless the prefix is exported with a different route-target. If the best path goes down, the destination will not be reachable until the next import event occurs, and then a new best path will be imported into the VRF table. The import event runs every 15 seconds by default.

The **import** keyword allows you to configure the VRF table to accept multiple redundant paths in addition to the best path. An import path is a redundant path, and it can have a next hop that matches an installed multipath.This feature should be used when there are multiple paths with identical next hops available to ensure optimal convergence times. A typical application of this feature is to configure redundant paths in a network that has multiple route reflectors for redundancy.

Note Configuring redundant paths with the **import** keyword can increase CPU and memory utilization significantly, especially in a network where there are many prefixes to learn and a large number of configured VRFs. It is recommended that this feature is only configured as necessary and that the minimum number of redundant paths are configured (Typically, not more than two).

Examples

In the following example, the router is configured to install 2 parallel routes in the BGP routing table:

```
Router(config)# router bgp 40000
Router(config-router)# maximum-paths 2
```

In the following example, the router is configured to install 6 equal-cost routes and 2 import routes (backup) in the VRF routing table:

```
Router(config)# router bgp 40000
Router(config-router)# address-family ipv4 vrf RED
Router(config-router-af)# maximum-paths 6 import 2
```

In the following example, the router is configured to install 2 import routes in the VRF routing table:

```
Router(config)# router bgp 100
Router(config-router)# address-family ipv4 vrf BLUE
Router(config-router-af)# maximum-paths import 2
```

maximum-paths eibgp

To configure multipath load sharing for external BGP (eBGP) and internal (iBGP) routes, use the **maximum-paths eibgp** command in address family configuration mode. To disable multipath load sharing for eBGP and iBGP routes, use the **no** form of this command.

maximum-paths eibgp *number* [**import** *number*]

no maximum-paths eibgp *number* [**import** *number*]

Syntax Description

number	Specifies the number of routes to install to the routing table. See the usage guidelines for the number of paths that can be configured with this argument.
import *number*	(Optional) Specifies the number of redundant paths that can be configured as back up multipaths for a VRF. This keyword can only be configured under a VRF in address family configuration mode. **Note** We recommend that this feature is enabled only where needed and that the number of import paths be kept to the minimum (Typically, not more than two paths). For more information, see the related note in the usage guidelines of this command reference page.

Defaults

Border Gateway Protocol (BGP) by default will install only one best path in the routing table.

Command Modes

Address family configuration

Command History

Release	Modification
12.2(4)T	This command was introduced.
12.0(24)S	This command was integrated into Cisco IOS Release 12.0(24)S.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.0(25)S	The **import** keyword was introduced.
12.2(13)T	The **import** keyword was integrated into Cisco IOS Release 12.2(13)T.
12.2(14)S	The **import** keyword was integrated into Cisco IOS Release 12.2(14)S.

Usage Guidelines

The **maximum-paths eibgp** command used to configure Border Gateway Protocol (BGP) multipath load sharing in an Multiprotocol Label Switching (MPLS) virtual private network (VPN) using eBGP and iBGP routes. This feature is configured under a virtual routing and forwarding instance (VRF) in address family configuration mode. The number of multipaths is configured separately for each VRF. The number of paths that can be configured is determined by the version of Cisco IOS software. The following list shows current limits:

- Cisco IOS Release 12.0S based software: 8 paths
- Cisco IOS Release 12.3T based software: 16 paths
- Cisco IOS Release 12.2S based software: 32 paths

The **maximum-paths eibgp** command cannot be configured with the **maximum-paths** or **maximum-paths ibgp** command because the **maximum-paths eibgp** command is a superset of these commands.

Note The configuration of this command does not override the existing outbound routing policy.

Configuring VRF Import Paths

A VRF will import only one path (best path) per prefix from the source VRF table, unless the prefix is exported with a different route-target. If the best path goes down, the destination will not be reachable until the next import event occurs, and then a new best path will be imported into the VRF table. The import event runs every 15 seconds by default.

The **import** keyword allows you to configure the VRF table to accept multiple redundant paths in addition to the best path. An import path is a redundant path, and it can have a next hop that matches an installed multipath.This feature should be used when there are multiple paths with identical next hops available to ensure optimal convergence times. A typical application of this feature is to configure redundant paths in a network that has multiple route reflectors for redundancy.

Note Configuring redundant paths with the **import** keyword can increase CPU and memory utilization significantly, especially in a network where there are many prefixes to learn and a large number of configured VRFs. It is recommended that this feature is only configured as necessary and that the minimum number of redundant paths are configured (Typically, not more than two).

Examples

In the following example, the router is configured to install 6 eBGP or iBGP routes into the VRF routing table:

```
Router(config)# router bgp 40000
Router(config-router)# address-family ipv4 vrf YELLOW
Router(config-router-af)# maximum-paths eibgp 6
```

In the following example, the router is configured to install 4 equal-cost routes and 2 import routes (backup) in the VRF routing table:

```
Router(config)# router bgp 45000
Router(config-router)# address-family ipv4 vrf GREEN
Router(config-router-af)# maximum-paths eibgp 4 import 2
```

In the following example, the router is configured to install 2 import routes in the VRF routing table:

```
Router(config)# router bgp 50000
Router(config-router)# address-family ipv4 vrf ORANGE
Router(config-router-af)# maximum-paths eibgp import 2
```

Related Commands

Command	Description
maximum-paths	Configures the number of equal-cost routes that BGP will install in the routing table.
maximum-paths ibgp	Configures the number of equal-cost or unequal-cost routes that BGP will install in the routing table.
show ip bgp	Displays entries in the BGP routing table.

maximum-paths ibgp

To configure the number of number of equal-cost or unequal-cost routes that internal BGP (iBGP) will install in the routing table, use the **maximum-paths ibgp** command in router configuration mode. To restore the default value, use the **no** form of this command.

maximum-paths ibgp *number* [**import** *number*] | **unequal-cost** *number* [**import** *number*]

no maximum-paths ibgp *number* [**import** *number*] | **unequal-cost** *number* [**import** *number*]

Syntax Description

number	Specifies the number of routes to install to the routing table. See the usage guidelines for the number of paths that can be configured with this argument.
unequal-cost *number*	Specifies the number of unequal-cost routes to install to the routing table.
import *number*	(Optional) Specifies the number of redundant paths that can be configured as back up multipaths for a VRF. This keyword can only be configured under a VRF in address family configuration mode. **Note** We recommend that this feature is enabled only where needed and that the number of import paths be kept to the minimum (Typically, not more than two paths). For more information, see the related note in the usage guidelines of this command reference page.

Defaults

Border Gateway Protocol (BGP) by default will install only one best path in the routing table.

Command Modes

Address family configuration
Router configuration

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.0(25)S	The **import** keyword was introduced.
12.2(13)T	The **import** keyword was integrated into Cisco IOS Release 12.2(13)T.
12.2(14)S	The **import** keyword was integrated into Cisco IOS Release 12.2(14)S.

Usage Guidelines

The **maximum-paths ibgp** command is used to configure equal-cost or unequal-cost multipath load sharing for iBGP peering sessions. In order for a route to be installed as a multipath in the BGP routing table, the route cannot have a next hop that is the same as another route that is already installed. The BGP routing process will still advertise a best path to iBGP peers when iBGP multipath load sharing is configured. For equal-cost routes, the path from the neighbor with the lowest router ID is advertised ad the best path.

To configure equal-cost multipath load sharing, all path attributes must be the same. The path attributes include weight, local preference, autonomous system path (entire attribute and not just the length), origin code, Multi Exit Discriminator (MED), and Interior Gateway Protocol (IGP) distance.

Configuring VRF Import Paths

A VRF will import only one path (best path) per prefix from the source VRF table, unless the prefix is exported with a different route-target. If the best path goes down, the destination will not be reachable until the next import event occurs, and then a new best path will be imported into the VRF table. An import path is a redundant path, and it can have a next hop that matches an installed multipath. The import event runs every 15 seconds by default.

The **import** keyword allows the network operator to configure the VRF table to accept multiple redundant paths in addition to the best path. This feature should be used when there are multiple paths with identical next hops available to ensure optimal convergence times. A typical application of this feature is to configure redundant paths in a network that has multiple route reflectors for redundancy.

Note Configuring redundant paths with the **import** keyword can increase CPU and memory utilization significantly, especially in a network where there are many prefixes to learn and a large number of configured VRFs. It is recommended that this feature is only configured as necessary and that the minimum number of redundant paths are configured (Typically, not more than two).

Examples

In the following example, the router is configured to install 6 equal-cost iBGP paths in the routing table. This router is not configured in to use MPLS.

```
Router(config)# router bgp 40000
Router(config-router)# address-family ipv4
Router(config-router-af)# maximum-paths ibgp 6
```

In the following example, the router is configured to install 3 equal-cost iBGP paths in the VRF routing table. This router is part of a MPL-VPN topology.

```
Router(config)# router bgp 45000
Router(config-router)# address-family ipv4 unicast vrf RED
Router(config-router-af)# maximum-paths ibgp 3
```

In the following example, the router is configured to install 2 unequal-cost routes and 2 import routes (backup) in the VRF routing table:

```
Router(config)# router bgp 50000
Router(config-router)# address-family ipv4 vrf YELLOW
Router(config-router-af)# maximum-paths ibgp unequal-cost 2 import 2
```

Related Commands

Command	Description
maximum-paths	Configures the number of equal-cost routes that BGP will install in the routing table.
maximum-paths eibgp	Configures the number of equal-cost eBGP or iBGP routes that BGP will install in the routing table.
show ip bgp	Displays entries in the BGP routing table.

max-area-addresses

To configure additional manual addresses for an IS-IS area, use the **max-area-addresses** command in router configuration mode. To disable the manual addresses, use the **no** form of this command.

max-area-addresses *number*

no max-area-addresses *number*

Syntax Description

number	Number of manual addresses to add. The range is from 3 to 234. There is no default value.

Command Default

No manual addresses are configured for an IS-IS area.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The **max-area-addresses** command allows you to maximize the size of an IS-IS area by configuring additional manual addresses. You specify the number of manual addresses that you want to add by entering the **max-area-addresses** command, and you assign a NET address to create each manual address by entering the **net** command.

Examples

The following example configures three manual addresses as follows:

```
router isis
 max-area-addresses 3
 net 50.3131.3131.3131.00
 net 51.3131.3131.3131.00
 net 52.3131.3131.3131.00
```

In the following example, an error message appears because the user has exceeded the maximum number of manual addresses that were configured with the **max-area-addresses** command:

```
router isis
 max-area-addresses 2
 net 50.3131.3131.3131.00
 net 51.3131.3131.3131.00
 net 52.3131.3131.3131.00
%The maximum allowed addresses already configured
```

Related Commands

Command	Description
net	Assigns a NET address to an IS-IS router.

max-metric router-lsa

To configure a router that is running the Open Shortest Path First (OSPF) protocol to advertise a maximum metric so that other routers do not prefer the router as an intermediate hop in their shortest path first (SPF) calculations, use the **max-metric router-lsa** command in router configuration mode. To disable the advertisement of a maximum metric, use the **no** form of this command.

max-metric router-lsa [on-startup {*announce-time* | **wait-for-bgp**}]

no max-metric router-lsa [on-startup {*announce-time* | **wait-for-bgp**}]

Syntax Description

on-startup	(Optional) Configures the router to advertise a maximum metric at startup.
announce-time	(Optional) Advertises a maximum metric for the specified time interval. The configurable range is from 5 to 86400 seconds. There is no default timer value for this configuration option.
wait-for-bgp	(Optional) Advertises a maximum metric until BGP routing tables have converged or the default timer has expired. The default timer is 600 seconds.

Defaults

Router link-state advertisements (LSAs) are originated with normal link metrics.

Command Modes

Router configuration

Command History

Release	Modification
12.0(15)S	This command was introduced.
12.0(16)ST	This command was integrated into Cisco IOS Release 12.0(16)ST.
12.2(4)T	This command was integrated into Cisco IOS Release 12.2(4)T.

Usage Guidelines

Enabling the **max-metric router-lsa** command will cause a router to originate LSAs with a maximum metric (LSInfinity: 0xFFFF) through all nonstub links, which allows BGP routing tables to converge without attracting transit traffic (if there are not alternate lower cost paths around the router). The router will advertise accurate (normal) metrics after the configured or default timers expire or after BGP sends a notification that routing tables have converged.

Note Directly connected links in a stub network are not affected by the configuration of a maximum or infinite metric because the cost of a stub link is always set to the output interface cost.

The **max-metric router-lsa** command is useful in the following situations:

- Reloading a router. After a router is reloaded, Interior Gateway Protocols (IGPs) converge very quickly, and other routers may try to forward traffic through the newly reloaded router. If the router is still building BGP routing tables, packets destined for other networks that the router has not learned through BGP may be dropped. In the case of an Internet backbone router, a large number of packets may be dropped.

- Introducing a router into a network without routing traffic through it. You may want to connect a router to an OSPF network but not want real traffic flowing through the router if there are better alternate paths. If there are no alternate paths, then this router would still accept transit traffic as before.
- Gracefully removing a router from a network. This feature allows you to gracefully remove a router from the network by advertising a maximum metric through all links, which allows other routers to select alternate paths for transit traffic to follow before the router is shut down.

Note You should not save the running configuration of a router when it is configured for a graceful shutdown because the router will continue to advertise a maximum metric after it is reloaded.

Note In older OSPF implementations (RFC 1247 and earlier implementations), the router link costs in received LSAs with a metric of LSInfinity are not used during SPF calculations, which means that no transit traffic will be sent to the routers originating these LSAs.

Examples

The following example configures a router that is running OSPF to advertise a maximum metric for 100 seconds:

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa on-startup 100
```

The following example configures a router to advertise a maximum metric until BGP routing tables converge or until the default timer expires (600 seconds):

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa on-startup wait-for-bgp
```

The following example configures a router that is running OSPF to advertise a maximum metric until the router shuts down:

```
Router(config)# router ospf 100
 Router(config-router)# max-metric router-lsa
 Router(config-router)# exit
 Router(config)# exit
 Router# show ip ospf
```

Related Commands

Command	Description
show ip ospf	Displays general information about OSPF routing processes.
show ip ospf database	Displays lists of information related to the OSPF database for a specific router.

metric holddown

To keep new Enhanced Interior Gateway Routing Protocol (EIGRP) routing information from being used for a certain period of time, use the **metric holddown** command in router configuration mode. To disable this feature, use the **no** form of this command.

metric holddown

no metric holddown

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The holddown state keeps new routing information from being used for a certain period of time. This function can prevent routing loops caused by slow convergence. It is sometimes advantageous to disable the holddown state to increase the ability of the network to quickly respond to topology changes; this command provides this function.

Use the **metric holddown** command if other routers or access servers within the autonomous system are not configured with the **no metric holddown** command. If all routers are not configured the same way, you increase the possibility of routing loops.

Examples

The following example disables metric holddown:

```
router eigrp 15
 network 172.16.0.0
 network 192.168.7.0
 no metric holddown
```

Related Commands

Command	Description
metric maximum-hops	Causes the IP routing software to advertise as unreachable those routes with a hop count higher than is specified by the command (EIGRP only).
metric weights (EIGRP)	Allows the tuning of the EIGRP metric calculations.

metric maximum-hops

To have the IP routing software advertise as unreachable those routes with a hop count higher than is specified by the command (Enhanced Interior Gateway Routing Protocol [EIGRP] only), use the **metric maximum-hops** command in router configuration mode. To reset the value to the default, use the **no** form of this command.

metric maximum-hops *{hops-number}*

no metric maximum-hops {*hops-number}*

Syntax Description

hops-number	Maximum hop count (in decimal). The default value is 100 hops; the maximum number of hops that can be specified is 255.

Defaults

100 hops

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command provides a safety mechanism that breaks any potential *count-to-infinity* problems. It causes the IP routing software to advertise as unreachable routes with a hop count greater than the value assigned to the *hops-number* argument.

Examples

In the following example, a router in autonomous system 71 attached to network 15.0.0.0 wants a maximum hop count of 200, doubling the default. The network administrators configured the router hop count to 200 because they have a complex WAN that can generate a large hop count under normal (nonlooping) operations.

```
router eigrp 71
 network 172.16.0.0
 metric maximum-hops 200
```

Related Commands

Command	Description
metric holddown	Keeps new EIGRP routing information from being used for a certain period of time.
metric weights (EIGRP)	Allows the tuning of the EIGRP metric calculations.

metric weights (EIGRP)

To allow the tuning of Enhanced Interior Gateway Routing Protocol (EIGRP) metric calculations, use the **metric weights** command in router configuration mode. To reset the values to their defaults, use the **no** form of this command.

metric weights *tos k1 k2 k3 k4 k5*

no metric weights

Syntax Description

tos	Type of service must always be zero.
k1k2 k3 k4 k5	Constants that convert an EIGRP metric vector into a scalar quantity.

Defaults

tos: 0

k1: 1

k2: 0

k3: 1

k4: 0

k5: 0

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use this command to alter the default behavior of EIGRP routing and metric computation and allow the tuning of the EIGRP metric calculation for a particular type of service (ToS).

If k5 equals 0, the composite EIGRP metric is computed according to the following formula:

metric = [k1 * bandwidth + (k2 * bandwidth)/(256 - load) + k3 * delay]

If k5 does not equal zero, an additional operation is performed:

metric = metric * [k5/(reliability + k4)]

Bandwidth is inverse minimum bandwidth of the path in BPS scaled by a factor of $2.56 * 10^{12}$. The range is from a 1200-bps line to 10 terabits per second.

Delay is in units of 10 microseconds. The range of delay is from 10 microseconds to 168 seconds. A delay of all ones indicates that the network is unreachable.

The delay parameter is stored in a 32-bit field, in increments of 39.1 nanoseconds. The range of delay is from 1 (39.1 nanoseconds) to hexadecimal FFFFFFFF (decimal 4,294,967,040 nanoseconds). A delay of all ones (that is, a delay of hexadecimal FFFFFFFF) indicates that the network is unreachable.

Table 4 lists the default values used for several common media.

Table 4 Bandwidth Values by Media Type

Media Type	Delay	Bandwidth
Satellite	5120 (2 seconds)	5120 (500 megabits)
Ethernet	25600 (1 milliseconds [ms])	256000 (10 megabits)
1.544 Mbps	512000 (20,000 ms)	1,657,856 bits
64 kbps	512000 (20,000 ms)	40,000,000 bits
56 kbps	512000 (20,000 ms)	45,714,176 bits
10 kbps	512000 (20,000 ms)	256,000,000 bits
1 kbps	512000 (20,000 ms)	2,560,000,000 bits

Reliability is given as a fraction of 255. That is, 255 is 100 percent reliability or a perfectly stable link.

Load is given as a fraction of 255. A load of 255 indicates a completely saturated link.

Examples

The following example sets the metric weights to slightly different values than the defaults:

```
router eigrp 109
 network 192.168.0.0
 metric weights 0 2 0 2 0 0
```

Related Commands

Command	Description
bandwidth (interface)	Sets a bandwidth value for an interface.
delay (interface)	Sets a delay value for an interface.
metric holddown	Keeps new EIGRP routing information from being used for a certain period of time.
metric maximum-hops	Causes the IP routing software to advertise as unreachable those routes with a hop count higher than is specified by the command (EIGRP only).