CHAPTER 17

# IP Routing Protocols Commands

Cisco's implementation of the Internet Protocol (IP) suite provides all major services contained in the TCP/IP specifications.

Use the commands in this chapter to configure and monitor the IP routing protocols. For IP routing protocol configuration information and examples, refer to the "Configuring IP Routing Protocols" chapter of the *Router Products Configuration Guide*.

# aggregate-address

To create an aggregate entry in a BGP routing table, use the **aggregate-address** router configuration command. To disable this feature, use the **no** form of this command.

**aggregate-address** *address mask* [**as-set**] [**summary-only**] [**suppress-map** *map-name*]
**no aggregate-address** *address mask* [**as-set**] [**summary-only**] [**suppress-map** *map-name*]

## Syntax Description

| | |
|---|---|
| *address* | Aggregate address. |
| *mask* | Aggregate mask. |
| **as-set** | (Optional) Generates autonomous system set path information. |
| **summary-only** | (Optional) Filters more specific routes from updates. |
| **suppress-map** *map-name* | (Optional) Name of route-map to suppress. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

You can implement aggregate routing in BGP either by redistributing an aggregate route into BGP or by using this conditional aggregate routing feature.

Using the **aggregate-address** command with no arguments will create an aggregate entry in the BGP routing table if there are any more-specific routes available that fall in the specified range. The aggregate route will be advertised as coming from your autonomous system and has the atomic aggregate attribute set to show that information might be missing. (By default, the atomic aggregate attribute is set unless you specify the **as-set** keyword in the **aggregate-address** command.)

Using the **as-set** keyword creates an aggregate entry using the same rules that the command follows without this keyword, but the path advertised for this route will be an AS_SET consisting of all elements contained in all paths that are being summarized. Do not use this form of **aggregate-address** when aggregating many paths, because this route must be continually withdrawn and re-updated as autonomous system path reachability information for the summarized routes changes.

Using the **summary-only** keyword not only creates the aggregate route (for example, 193.*.*.*) but will also suppress advertisements of more specific routes to all neighbors. If you only want to suppress advertisements to certain neighbors, you may use the **neighbor distribute-list** command, with caution. If a more-specific route leaks out, all BGP speakers will prefer that route over the less-specific aggregate you are generating (using longest-match routing).

Using the **suppress-map** keyword creates the aggregate route but suppresses advertisement of specified route maps. You can use the **match** clauses of route maps to selectively suppress some more specific routes of the aggregate and leave others unsuppressed. IP access lists and AS path access lists match clauses are supported.

## Example

In the following example, an aggregate address is created. The path advertised for this route will be an AS_SET consisting of all elements contained in all paths that are being summarized.

```
router bgp 5
aggregate-address 193.0.0.0 255.0.0.0 as-set
```

## Related Commands

**match ip address**
**match as-path**
**route-map**

# area authentication

To enable authentication for an OSPF area, use the **area authentication** router configuration command. To remove an area's authentication specificationor a specified area from the router's configuration, use the **no** form of this command.

**area** *area-id* **authentication**
**no area** *area-id* **authentication**
**no area** *area-id*

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier of the area for which authentication is to be enabled. The identifier can be specified as either a decimal value or an IP address. |

## Default

Type 0 authentication (no authentication)

## Command Mode

Router configuration

## Usage Guidelines

Specifying authentication for an area sets the authentication to Type 1 (simple password) as specified in RFC 1247. If this command is not included in the configuration file, authentication of Type 0 (no authentication) is assumed.

The authentication type must be the same for all routers in an area. The authentication password for all OSPF routers on a network must be the same if they are to communicate with each other via OSPF. Use the **ip ospf authentication-key** interface configuration command to specify this password.

To remove the area's authentication specification, use the **no** form of this command with the **authentication** keyword. To remove the specified area from the router's configuration, use the command **no area** *area-id* (with no other keywords).

## Example

The following example mandates authentication for areas 0 and 36.0.0.0 of OSPF routing process 201. Authentication keys are also provided.

```
interface ethernet 0
ip address 131.119.251.201 255.255.255.0
ip ospf authentication-key adcdefgh
!
interface ethernet 1
ip address 36.56.0.201 255.255.0.0
ip ospf authentication-key ijklmnop
!
router ospf 201
network 36.0.0.0 0.255.255.255 area 36.0.0.0
network 131.119.0.0 0.0.255.255 area 0
area 36.0.0.0 authentication
area 0 authentication
```

## Related Commands

**area default-cost**
**area stub**
**ip ospf authentication-key**

# area default-cost

To specify a cost for the default summary route sent into a stub area, use the **area default-cost** router configuration command. To remove the assigned default route cost, use the **no** form of this command.

**area** *area-id* **default-cost** *cost*
**no area** *area-id* **default-cost** *cost*

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier for the stub area. The identifier can be specified as either a decimal value or as an IP address. |
| *cost* | Cost for the default summary route used for a stub area. The acceptable value is a 24-bit number. |

## Default

Cost of 1

## Command Mode

Router configuration

## Usage Guidelines

This command is used only on an area border router attached to a stub area.

There are two stub area router configuration commands: the **stub** and **default-cost** options of the **area** command. In all routers attached to the stub area, the area should be configured as a stub area using the **stub** option of the **area** command. Use the **default-cost** option only on an area border router attached to the stub area. The **default-cost** option provides the metric for the summary default route generated by the area border router into the stub area.

## Example

The following example assigns a default-cost of 20 to stub network 36.0.0.0:

```
interface ethernet 0
ip address 36.56.0.201 255.255.0.0
!
router ospf 201
network 36.0.0.0 0.255.255.255 area 36.0.0.0
area 36.0.0.0 stub
area 36.0.0.0 default-cost 20
```

## Related Commands

**area authentication**
**area stub**

# area range

To consolidate and summarize routes at an area boundary, use the **area range** router configuration command. To disable this function, use the **no** form of this command.

**area** *area-id* **range** *address mask*
**no area** *area-id* **range** *address mask*

### Syntax Description

| | |
|---|---|
| *area-id* | Identifier of the area about which routes are to be summarized. It can be specified as either a decimal value or as an IP address. |
| *address* | IP address. |
| *mask* | IP mask. |

### Default

Disabled

### Command Mode

Router configuration

### Usage Guidelines

The **area range** command is used only with area border routers. It is used to consolidate or summarize routes for an area. The result is that a single summary route is advertised to other areas by the area border router. Routing information is condensed at area boundaries. External to the area, a single route is advertised for each address range. This is called *route summarization*.

Multiple **area** router configuration commands specifying the **range** option can be configured. Thus, OSPF can summarize addresses for many different sets of address ranges.

### Example

The following example specifies one summary route to be advertised by the area border router to other areas for all subnets on network 36.0.0.0 and for all hosts on network 192.42.110.0:

```
interface ethernet 0
ip address 192.42.110.201 255.255.255.0
!
interface ethernet 1
ip address 36.56.0.201 255.255.0.0
!
router ospf 201
network 36.0.0.0 0.255.255.255 area 36.0.0.0
network 192.42.110.0 0.0.0.255 area 0
area 36.0.0.0 range 36.0.0.0 255.0.0.0
area 0 range 192.42.110.0 255.255.255.0
```

# area stub

To define an area as a stub area, use the **area stub** router configuration command. To disable this function, use the **no** form of this command.

**area** *area-id* **stub**
**no area** *area-id* **stub**

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier for the stub area. The identifier can be either a decimal value or an IP address. |

## Default

No stub area is defined.

## Command Mode

Router configuration

## Usage Guidelines

You must configure the **area stub** command on all routers in the stub area. Use the **area** router configuration command with the **default-cost** option to specify the cost of a default internal router sent into a stub area by an area border router.

There are two stub area router configuration commands: the **stub** and **default-cost** options of the **area** router configuration command. In all routers attached to the stub area, the area should be configured as a stub area using the **stub** option of the **area** command. Use the **default-cost** option only on an area border router attached to the stub area. The **default-cost** option provides the metric for the summary default route generated by the area border router into the stub area.

## Example

The following example assigns a default cost of 20 to stub network 36.0.0.0:

```
interface ethernet 0
ip address 36.56.0.201 255.255.0.0
!
router ospf 201
network 36.0.0.0 0.255.255.255 area 36.0.0.0
area 36.0.0.0 stub
area 36.0.0.0 default-cost 20
```

## Related Commands

**area authentication**
**area default-cost**

# area virtual-link

To define an OSPF virtual link, use the **area virtual-link** router configuration command with the optional parameters. To remove a virtual link, use the **no** form of this command.

**area** *area-id* **virtual-link** *router-id* [**hello-interval** *seconds*] [**retransmit-interval** *seconds*] [**transmit-delay** *seconds*] [**dead-interval** *seconds*] [**authentication-key** *password*]
**no area** *area-id* **virtual-link** *router-id* [**hello-interval** *seconds*] [**retransmit-interval** *seconds*] [**transmit-delay** *seconds*] [**dead-interval** *seconds*] [**authentication-key** *password*]

## Syntax Description

| | |
|---|---|
| *area-id* | Area ID assigned to the transit area for the virtual link. This can be either a decimal value or a valid IP address. There is no default. |
| *router-id* | Router ID associated with the virtual link neighbor. The router ID appears in the **show ip ospf** display. It is internally derived by each router from the router's interface IP addresses. This value must be entered in the format of an IP address. There is no default. |
| **hello-interval** | (Optional) Time in seconds between the Hello packets that the router sends on an interface. |
| *seconds* | (Optional) Unsigned integer value to be advertised in the router's Hello packets. The value must be the same for all routers attached to a common network. The default is 10 seconds. |
| **retransmit-interval** | (Optional) Time in seconds between link state advertisement retransmissions for adjacencies belonging to the interface. |
| *seconds* | (Optional) Expected round-trip delay between any two routers on the attached network. The value must be greater than the expected round-trip delay. The default is 5 seconds. |
| **transmit-delay** | (Optional) Estimated time in seconds it takes to transmit a link state update packet on the interface. |
| *seconds* | (Optional) Integer value that must be greater than zero. Link state advertisements in the update packet have their age incremented by this amount before transmission. The default value is 1 second. |
| **dead-interval** | (Optional) Time in seconds that a router's Hello packets are not seen before its neighbors declare the router down. |

| | |
|---|---|
| *seconds* | (Optional) Unsigned integer value. The default is four times the Hello interval, or 40 seconds. As with the Hello interval, this value must be the same for all routers attached to a common network. |
| **authentication-key** | (Optional) Password to be used by neighboring routers. |
| *password* | (Optional) Any continuous string of characters that you can enter from the keyboard up to 8 bytes in length. This string acts as a key that will allow the authentication procedure to generate or verify the authentication field in the OSPF header. This key is inserted directly into the OSPF header when originating routing protocol packets. A separate password can be assigned to each network on a per-interface basis. All neighboring routers on the same network must have the same password to be able to route OSPF traffic. The password is encrypted in the configuration file if the **service password-encryption** command is enabled. There is no default value. |

## Default

*area-id*: No area ID is predefined.
*router-id*: No router ID is predefined.
**hello-interval** *seconds*: 10 seconds
**retransmit-interval** *seconds*: 10 seconds
**transmit-delay** *seconds*: 1 second
**dead-interval** *seconds*: 40 seconds
**authentication-key** *password*: No password is predefined.

## Command Mode

Router configuration

## Usage Guidelines

In OSPF, all areas must be connected to a backbone area. If the connection to the backbone is lost, it can be repaired by establishing a virtual link.

The smaller the Hello interval, the faster topological changes will be detected, but more routing traffic will ensue.

The setting of the retransmit interval should be conservative, or needless retransmissions will result. The value should be larger for serial lines and virtual links.

The transmit delay value should take into account the transmission and propagation delays for the interface.

A router will use the specified authentication key only when authentication is enabled for the backbone with the **area** *area-id* **authentication** router configuration command.

Any keywords and arguments you specify after the **authentication-key** *password* keyword-argument pair are ignored. Therefore, specify any optional arguments before this keyword-argument pair.

**Note** Each virtual link neighbor must include the transit area ID and the corresponding virtual link neighbor's router ID in order for a virtual link to be properly configured. Use the **show ip ospf** EXEC command to see the router ID of a router.

## Example

The following example establishes a virtual link with default values for all optional parameters:

```
router ospf 201
network 36.0.0.0 0.255.255.255 area 36.0.0.0
area 36.0.0.0 virtual-link 36.3.4.5
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**area authentication**
**service password-encryption** †
**show ip ospf**

# area-password

To configure the IS-IS area authentication password, use the **area-password** router configuration command. To disable the password, use the **no** form of this command.

**area-password** *password*
**no area-password** [*password*]

## Syntax Description

| | |
|---|---|
| *password* | Password you assign. |

## Default

No area password is defined.

## Command Mode

Router configuration

## Usage Guidelines

This password is inserted in Level 1 (station router level) link state PDUs (LSPs), complete sequence number PDUs (CSNPs), and partial sequence number PDUs (PSNP).

## Example

The following example assigns an area authentication password:

```
router isis
area-password angel
```

## Related Command

**domain-password**

# auto-summary

To restore the default dehavior of automatic summarization of subnet routes into network-level routes, use the **auto-summary** router configuration command. To disable this feature, use the **no** form of this command.

**auto-summary**
**no auto-summary**

## Syntax Description

This command has no arguments or keywords.

## Default

Enabled

## Command Mode

Router configuration

## Usage Guidelines

By default, BGP does not accept subnets redistributed from IGP. To advertise and carry subnet routes in BGP, use an explicit **network** command or the **no auto-summary** command. If you disable auto-summarization and have not entered a **network** command, you will not advertise network routes for networks with subnet routes unless they contain a summary route.

IP Enhanced IGRP summary routes are given an administrative distance value of 5. You cannot configure this value.

## Examples

In the following example, network numbers are not summarized automatically:

```
router bgp 6
no auto-summary
```

The following example disables automatic summarization for router process eigrp 109:

```
router eigrp 109
no auto-summary
```

## Related Command

**ip summary-address eigrp**

# autonomous-system (EGP)

To specify the local autonomous system that the router resides in for EGP, use the **autonomous-system** global configuration command . To remove the autonomous system number, use the **no** form of this command.

**autonomous-system** *local-as*
**no autonomous-system** *local-as*

## Syntax Description

| | |
|---|---|
| *local-as* | Local autonomous system number to which the router belongs |

## Default

No local autonomous system is specified.

## Command Mode

Global configuration

## Usage Guidelines

Before you can set up EGP routing, you must specify an autonomous system number. The local autonomous system number will be included in EGP messages sent by the router.

## Example

The following sample configuration specifies an autonomous system number of 110:

```
autonomous-system 110
```

## Related Command

**router egp**

# bgp default local-preference

To change the default local preference value, use the **bgp default local-preference** command. To return to the default setting, use the **no** form of this command.

**bgp default local-preference** *value*
**no bgp default local-preference** *value*

## Syntax Description

| | |
|---|---|
| *value* | Local preference value. Higher is more preferred. Integer from 0 through 4294967295. |

## Default

Local preference value of 100

## Command Mode

Router configuration

## Usage Guidelines

Generally, the default value of 100 allows you to easily define a particular path as less preferable than paths with no local preference attribute. The preference is sent to all routers in the local autonomous system.

## Example

In the following example, the default local preference value is raised from the default of 100 to 200:

```
router bgp 200
bgp default local-preference 200
```

## Related Command

**set local-preference**

# bgp fast-external-fallover

To immediately reset the BGP sessions of any directly adjacent external peers if the link used to reach them goes down, use the **bgp fast-external-fallover** router configuration command. To disable this feature, use the **no** form of this command.

**bgp fast-external-fallover**
[**no**] **bgp fast-external-fallover**

## Syntax Description

This command has no arguments or keywords.

## Default

Enabled

## Command Mode

Router configuration

## Example

In the following example, the automatic resetting of BGP sessions is disabled:

```
router bgp 109
no bgp fast-external-fallover
```

# clear arp-cache

To remove all dynamic entries from the ARP cache and to clear the fast-switching cache, use the **clear arp-cache** EXEC command.

**clear arp-cache**

### Syntax Description

This command has no arguments or keywords.

### Command Mode

EXEC

### Example

The following example removes all dynamic entries from the ARP cache and clears the fast-switching cache:

```
clear arp-cache
```

# clear ip bgp

To reset a BGP connection, use the **clear ip bgp** EXEC command at the system prompt.

**clear ip bgp** {***** | *address*}

## Syntax Description

| | |
|---|---|
| ***** | Resets all current BGP sessions. |
| *address* | Resets only the identified BGP neighbor. |

## Command Mode

EXEC

## Usage Guidelines

Use this command whenever any of the following changes occur:

- Additions or changes to the BGP-related access lists
- Changes to BGP-related weights
- Changes to BGP-related distribution lists
- Changes in the BGP timer's specifications
- Changes to the BGP administrative distance

## Example

The following example shows how to reset all current BGP sessions:

```
clear ip bgp *
```

## Related Commands

**show ip bgp**
**timers bgp**

# clear ip eigrp neighbors

To delete entries from the neighbor table, use the **clear ip eigrp neighbors** EXEC command.

**clear ip eigrp neighbors** [*ip-address* | *interface*]

### Syntax Description

| | |
|---|---|
| *ip-address* | (Optional) Address of the neighbor. |
| *interface* | (Optional) Interface type and number. Specifying this argument removes from the neighbor table all entries learned via this interface. |

### Command Mode

EXEC

### Example

The following example removes the neighbor whose address is 160.20.8.3:

```
clear ip eigrp neighbors 160.20.8.3
```

### Related Command

**show ip eigrp neighbors**

# clear ip igmp group

To delete entries from the IGMP cache, use the **clear ip igmp group** EXEC command.

**clear ip igmp group** [*group-name* | *group-address* | *interface*]

## Syntax Description

| | |
|---|---|
| *group-name* | (Optional) Name of the multicast group, as defined in the DNS hosts table or with the **ip host** command. |
| *group-address* | (Optional) Address of the multicast group. This is a multicast IP address in four-part dotted notation. |
| *interface* | (Optional) Interface type and number. |

## Command Mode

EXEC

## Usage Guidelines

The IGMP cache contains a list of the multicast groups of which hosts on the directly connected LAN are members. If the router has joined a group, it is also listed in the cache.

To delete all entries from the IGMP cache, specify the **clear ip igmp group** command with no arguments.

## Example

The following example clears entries for the multicast group 224.0.255.1 from the IGMP cache:

```
clear ip igmp group 224.0.255.1
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**ip host** †
**show ip igmp groups**
**show ip igmp interface**

# clear ip mroute

To delete entries from the IP multicast routing table, use the **clear ip mroute** EXEC command.

**clear ip mroute *** | {*group-name* [*source-address*] | *group-address* [*source-address*]}

## Syntax Description

| | |
|---|---|
| ***** | Deletes all entries from the IP multicast routing table. |
| *group-name* | Name of the multicast group, as defined in the DNS hosts table or with the **ip host** command. |
| *group-address* | Address of the multicast group. This is a multicast IP address in four-part dotted notation. |
| *source-address* | (Optional) Address of a multicast source that is transmitting to the group. A source does not need to be a member of the group. If you specify *source-address*, you must specify either *group-name* or *group-address*. |

## Command Mode

EXEC

## Examples

The following example deletes all entries from the IP multicast routing table:

```
clear ip mroute *
```

The following example deletes from the IP multicast routing table all sources on the 10.3.0.0 subnet that are transmitting to the multicast group 224.2.205.42. Note that this example deletes all sources on network 10.3, not individual sources.

```
clear ip mroute 224.2.205.42 10.3.0.0
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**ip host** †
**show ip mroute**

# clear ip route

To remove one or more routes from the IP routing table, use the **clear ip route** EXEC command.

**clear ip route** {*network* [*mask*] | ***}

### Syntax Description

| | |
|---|---|
| *network* | Network or subnet address to remove. |
| *mask* | (Optional) Network mask associated with the IP address you wish to remove. |
| * | Removes all entries. |

### Command Mode

EXEC

### Example

The following example removes a route to network 132.5.0.0 from the IP routing table:

```
clear ip route 132.5.0.0
```

### Related Command

**show ip route**

# default-information allowed

To control the redistribution of routing information between IGRP or Enhanced IGRP processes, use the **default-information allowed** router configuration command. To suppress IGRP or Enhanced IGRP exterior or default routes when they are received by an Enhanced IGRP process, use the **no default-information allowed in** command. To suppress IGRP or Enhanced IGRP exterior routes in updates, use the **no default-information allowed out** command.

**default-information allowed** {**in** | **out**} [**route-map** *map-tag*]
**no default-information allowed** {**in** | **out**} [**route-map** *map-tag*]

## Syntax Description

| | |
|---|---|
| **in** | Allows IGRP or Enhanced IGRP exterior or default routes to be received by an IGRP process. |
| **out** | Allows IGRP or Enhanced IGRP exterior routes to be advertised in updates. |
| **route-map** *map-tag* | (Optional) Indicates that the route map should be interrogated to filter the importation of routes from this source routing protocol to the current routing protocol. The argument *map-tag* is the identifier of a configured route map. If you specify **route-map** without specifying *map-tag*, no routes are imported. If you omit **route-map**, all routes are redistributed. |

## Default

Normally, exterior routes are always accepted and default information is passed between IGRP or Enhanced IGRP processes when performing redistribution.

## Command Mode

Router configuration

## Usage Guidelines

The default network of 0.0.0.0 used by RIP cannot be redistributed by IGRP or Enhanced IGRP.

The **no default-information allowed** command filters out candidate default information from routing updates. It has no effect on redistribution.

## Example

The following example allows IGRP exterior or default routes to be received by the IGRP process in autonomous system 23:

```
router igrp 23
default-information allowed in
```

# default-information originate (BGP)

To allow the redistribution of network 0.0.0.0 into BGP, use the **default-information originate** router configuration command. To disable this feature, use the **no** form of this command.

**default-information originate**
**no default-information originate**

### Syntax Description

This command has no arguments or keywords.

### Default

Disabled

### Command Mode

Router configuration

### Usage Guidelines

The same functionality will result from the **network 0.0.0.0** command, using the **network** router configuration command.

### Example

The following example configures BGP to redistribute network 0.0.0.0 into BGP:

```
router bgp 164
default-information originate
```

# default-information originate (EGP)

To explicitly configure EGP to generate a default route, use the **default-information originate** router configuration command. To disable this feature, use the **no** form of this command.

**default-information originate**
**no default-information originate**

### Syntax Description

This command has no arguments or keywords.

### Default

Disabled

### Command Mode

Router configuration

### Usage Guidelines

Because EGP can use network 0.0.0.0 as a default route, EGP must be explicitly configured to generate a default route. If the next hop for the default route can be advertised as a third party, it will be included as a third party.

### Example

The following example configures EGP to generate a default route:

```
autonomous system 109
router egp 164
network 131.108.0.0
network 192.31.7.0
neighbor 10.2.0.2
default-information originate
```

# default-information originate (IS-IS)

To generate a default route into an IS-IS routing domain, use the **default-information originate** router configuration command. To disable this feature, use the **no** form of this command.

**default-information originate** [**route-map** *map-name*]
**no default-information originate** [**route-map** *map-name*]

## Syntax Description

| | |
|---|---|
| **originate** | Originates the default route regardless of whether it resides in the routing table. |
| **route-map** *map-name* | (Optional) Routing process will generate the default route if the route-map is satisfied. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

If a router configured with this command has a route to 0.0.0.0 in the routing table, IS-IS will originate an advertisement for 0.0.0.0 in its LSPs.

## Example

In the following configuration, the router is forced to generate a default external route into an IS-IS domain:

```
router isis
! BGP routes will be distributed into IS-IS
redistribute bgp 120
! access list 2 is applied to outgoing routing updates
distribute-list 2 out
! metric of 60 is specified for default router redistributed into IS-IS
! routing domain.
default-information originate metric 60
! access list 2 defined as giving access to network 100.105.0.0
access-list 2 permit 100.105.0.0 0.0.255.255
```

## Related Commands

**isis metric**
**redistribute**

# default-information originate (OSPF)

To generate a default route into an OSPF routing domain, use the **default-information originate** router configuration command. To disable this feature, use the **no** form of this command.

**default-information originate** [**always**] [**metric** *metric-value*] [**metric-type** *type-value*] {**level-1** | **level-1-2** | **level-2**} [**route-map** *map-name*]
**no default-information originate** [**always**] [**metric** *metric-value*] [**metric-type** *type-value*] {**level-1** | **level-1-2** | **level-2**} [**route-map** *map-name*]

## Syntax Description

| | |
|---|---|
| **originate** | Causes the router to generate a default external route into an OSPF domain if the router already has a default route and you want to propagate to other routers. |
| **always** | (Optional) Always advertises the default route regardless of whether the router has a default route. |
| **metric** *metric-value* | (Optional) Metric used for generating the default route. If you omit a value and do not specify a value using the **default-metric** router configuration command, the default metric value is 10. The value used is specific to the protocol. |
| **metric-type** *type-value* | (Optional) External link type associated with the default route advertised into the OSPF routing domain. It can be one of the following values:<br>**1**—Type 1 external route<br>**2**—Type 2 external route<br>The default is Type 2 external route. |
| **level-1** | Level 1 routes are redistributed into other IP routing protocols independently. It specifies if IS-IS advertises network 0.0.0.0 into the Level 1 area. |
| **level-1-2** | Both Level 1 and Level 2 routes are redistributed into other IP routing protocols. It specifies if IS-IS advertises network 0.0.0.0 into both levels in a single command. |
| **level-2** | Level 2 routes are redistributed into other IP routing protocols independently. It specifies if IS-IS advertises network 0.0.0.0 into the Level 2 subdomain. |
| **route-map** *map-name* | (Optional) Routing process will generate the default route if the route-map is satisfied. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

Whenever you use the **redistribute** or the **default-information** router configuration commands to redistribute routes into an OSPF routing domain, the router automatically becomes an autonomous system boundary router. However, an autonomous system boundary router does not, by default, generate a *default route* into the OSPF routing domain. The router still needs to have a default route for itself before it generates one, except when you have specified the **always** keyword.

When you use this command for the OSPF process, the default network must reside in the routing table and you must satisfy the **route-map** *map-name* keyword. Use the **default-information originate always route-map** *map-name* form of the command when you do not want the dependency on the default network in the routing table.

## Example

The following example specifies a metric of 100 for the default route redistributed into the OSPF routing domain and an external metric type of Type 1:

```
router ospf 109
redistribute igrp 108 metric 100 subnets
default-information originate metric 100 metric-type 1
```

## Related Commands

**redistribute**

# default-metric (BGP, EGP, OSPF, and RIP)

To set default metric values for the BGP, EGP, OSPF, and RIP routing protocols, use this form of the **default-metric** router configuration command. To return to the default state, use the **no** form of this command.

**default-metric** *number*
**no default-metric** *number*

## Syntax Description

| | |
|---|---|
| *number* | Default metric value appropriate for the specified routing protocol |

## Default

Built-in, automatic metric translations, as appropriate for each routing protocol

## Command Mode

Router configuration

## Usage Guidelines

The **default-metric** command is used in conjunction with the **redistribute** router configuration command to cause the current routing protocol to use the same metric value for all redistributed routes. A default metric helps solve the problem of redistributing routes with incompatible metrics. Whenever metrics do not convert, using a default metric provides a reasonable substitute and enables the redistribution to proceed.

In BGP, this sets the MULTI_EXIT_DISC metric. (The name of this metric for BGP Versions 2 and 3 is INTER_AS.)

## Example

The following example shows a router in autonomous system 109 using both the RIP and the OSPF routing protocols. The example advertises OSPF-derived routes using the RIP protocol and assigns the IGRP-derived routes a RIP metric of 10.

```
router rip
default-metric 10
redistribute ospf 109
```

## Related Command

**redistribute**

# default-metric (IGRP and Enhanced IGRP only)

To set metrics for IGRP or Enhanced IGRP, use this form of the **default-metric** router configuration command. To remove the metric value and return to the default state, use the **no** form of this command.

**default-metric** *bandwidth delay reliability loading mtu*
**no default-metric** *bandwidth delay reliability loading mtu*

## Syntax Description

| | |
|---|---|
| *bandwidth* | Minimum bandwidth of the route in kilobits per second. It can be 0 or any positive integer. |
| *delay* | Route delay in tens of microseconds. It can be 0 or any positive number that is a multiple of 39.1 nanoseconds. |
| *reliability* | Likelihood of successful packet transmission expressed as a number between 0 and 255. The value 255 means 100 percent reliability, and the value 0 means no reliability. |
| *loading* | Effective bandwidth of the route in kilobits per second. It can be a number from 0 to 255. |
| *mtu* | Minimum maximum transmission unit (MTU) size of the route in bytes. It can be 0 or any positive integer. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

Metric defaults have been carefully set to work for a wide variety of networks. Take great care in changing these values.

Automatic metric translations are supported only when redistributing from IGRP, Enhanced IGRP, or static routes.

## Example

The following example takes redistributed RIP metrics and translates them into IGRP metrics with values as follows: bandwidth = 1000, delay = 100, reliability = 250, loading = 100, and mtu =1500.

```
router igrp 109
network 131.108.0.0
redistribute rip
default-metric 1000 100 250 100 1500
```

## Related Command

**redistribute**

# distance

To define an administrative distance, use the **distance** router configuration command. To remove a distance definition, use the **no** form of this command.

**distance** *weight* [*address mask* [*access-list-number*]] [**ip**]
**no distance** *weight* [*address mask* [*access-list-number*]] [**ip**]

## Syntax Description

| | |
|---|---|
| *weight* | Administrative distance. This can be an integer from 10 to 255. (The values 0 through 9 are reserved for internal use.) Used alone, the argument *weight* specifies a default administrative distance that the router uses when no other specification exists for a routing information source. Routes with a distance of 255 are not installed in the routing table. |
| *address* | (Optional) IP address in four-part dotted notation. |
| *mask* | (Optional) IP address mask in four-part dotted-decimal format. A bit set to 1 in the *mask* argument instructs the router to ignore the corresponding bit in the address value. |
| *access-list-number* | (Optional) Number of a standard IP access list to be applied to incoming routing updates. |
| **ip** | (Optional) IP-derived routes for IS-IS. It can be applied independently for IP routes and ISO CLNS routes. |

## Default

Table 17-1 lists default administrative distances.

**Table 17-1 Default Administrative Distances**

| Route Source | Default Distance |
|---|---|
| Connected interface | 0 |
| Static route | 1 |
| External BGP | 20 |
| IGRP | 100 |
| OSPF | 110 |
| IS-IS | 115 |
| RIP | 120 |
| EGP | 140 |
| Internal BGP | 200 |
| Unknown | 255 |

## Command Mode

Router configuration

## Usage Guidelines

Numerically, an administrative distance is an integer between 0 and 255. In general, the higher the value, the lower the trust rating. An administrative distance of 255 means the routing information source cannot be trusted at all and should be ignored.

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

The order in which you enter **distance** commands can affect the assigned administrative distances in unexpected ways (see "Example" for further clarification).

Weight values are also subjective; there is no quantitative method for choosing weight values.

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

The **show ip protocols** EXEC command displays the default administrative distance for a specified routing process.

## Example

In the following example, the **router igrp** global configuration command sets up IGRP routing in autonomous system number 109. The **network** router configuration commands specify IGRP routing on networks 192.31.7.0 and 128.88.0.0. The first **distance** router configuration command sets the default administrative distance to 255, which instructs the router to ignore all routing updates from routers for which an explicit distance has not been set. The second **distance** command sets the administrative distance for all routers on the Class C network 192.31.7.0 to 90. The third **distance** command sets the administrative distance for the router with the address 128.88.1.3 to 120.

```
router igrp 109
network 192.31.7.0
network 128.88.0.0
distance 255
distance 90  192.31.7.0  0.0.0.255
distance 120  128.88.1.3  0.0.0.0
```

## Related Command

**distance bgp**

# distance bgp

To allow the use of external, internal, and local administrative distances that could be a better route to a node, use the **distance bgp** router configuration command. To return to the default values, use the **no** form of this command.

**distance bgp** *external-distance internal-distance local-distance*
**no distance bgp**

## Syntax Description

| | |
|---|---|
| *external-distance* | Administrative distance for BGP external routes. External routes are routes for which the best path is learned from a neighbor external to the autonomous system. Acceptable values are from 1 to 255. The default is 20. Routes with a distance of 255 are not installed in the routing table. |
| *internal-distance* | Administrative distance for BGP internal routes. Internal routes are those routes that are learned from another BGP entity within the same autonomous system. Acceptable values are from 1 to 255. The default is 200. Routes with a distance of 255 are not installed in the routing table. |
| *local-distance* | Administrative distance for BGP local routes. Local routes are those networks listed with a **network** router configuration command, often as back doors, for that router or for networks that are being redistributed from another process. Acceptable values are from 1 to 255. The default is 200. Routes with a distance of 255 are not installed in the routing table. |

## Default

*external-distance*: 20
*internal-distance*: 200
*local-distance*: 200

## Command Mode

Router configuration

## Usage Guidelines

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

Use this command if another protocol is known to be able to provide a better route to a node than was actually learned via external BGP, or if some internal routes should really be preferred by BGP.

**Note** Changing the administrative distance of BGP internal routes is considered dangerous and is not recommended. One problem that can arise is the accumulation of routing table inconsistencies, which can break routing.

## Example

In the following example, internal routes are known to be preferable to those learned through the IGP, so the administrative distance values are set accordingly:

```
router bgp 109
network 131.108.0.0
neighbor 129.140.6.6 remote-as 123
neighbor 128.125.1.1 remote-as 47
distance bgp 20 20 200
```

## Related Command

**distance**

# distance eigrp

To allow the use of two administrative distances—internal and external—that could be a better route to a node, use the **distance eigrp** router configuration command. To reset these values to their defaults, use the **no** form of this command.

**distance eigrp** *internal-distance external-distance*
**no distance eigrp**

## Syntax Description

| | |
|---|---|
| *internal-distance* | Administrative distance for Enhanced IGRP internal routes. Internal routes are those that are learned from another entity within the same autonomous system. It can be a value from 1 to 255. |
| *external-distance* | Administrative distance for Enhanced IGRP external routes. External routes are those for which the best path is learned from a neighbor external to the autonomous system. It can be a value from 1 to 255. |

## Default

*internal-distance*: 90
*external-distance*: 170

## Command Mode

Router configuration

## Usage Guidelines

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

Use the **distance eigrp** command if another protocol is known to be able to provide a better route to a node than was actually learned via external Enhanced IGRP or if some internal routes should really be preferred by Enhanced IGRP.

Table 17-2 lists the default administrative distances.

**Table 17-2 Default Administrative Distances**

| Route Source | Default Distance |
|---|---|
| Connected interface | 0 |
| Static route | 1 |
| Enhanced IGRP summary route | 5 |
| External BGP | 20 |
| Internal enhanced IGRP | 90 |
| IGRP | 100 |
| OSPF | 110 |
| IS-IS | 115 |
| RIP | 120 |
| EGP | 140 |
| External enhanced IGRP | 170 |
| Internal BGP | 200 |
| Unknown | 255 |

To display the default administrative distance for a specified routing process, use the **show ip protocols** EXEC command.

## Example

In the following example, the **router eigrp** global configuration command sets up Enhanced IGRP routing in autonomous system number 109. The **network** router configuration commands specify Enhanced IGRP routing on networks 192.31.7.0 and 128.88.0.0. The first **distance** router configuration command sets the default administrative distance to 255, which instructs the router to ignore all routing updates from routers for which an explicit distance has not been set. The second **distance** router configuration command sets the administrative distance for all routers on the Class C network 192.31.7.0 to 90. The third **distance** router configuration command sets the administrative distance for the router with the address 128.88.1.3 to 120.

```
router eigrp 109
network 192.31.7.0
network 128.88.0.0
distance 255
!
! use caution when executing the next two commands!
!
distance 90 192.31.7.0 0.0.0.255
distance 120 128.88.1.3 0.0.0.0
```

## Related Command

**show ip protocols**

# distribute-list in

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

**distribute-list** *access-list-number* **in** [*interface-name*]
**no distribute-list** *access-list-number* **in** [*interface-name*]

## Syntax Description

| | |
|---|---|
| *access-list-number* | Standard IP access list number. The list defines which networks are to be received and which are to be suppressed in routing updates. |
| **in** | Applies the access list to incoming routing updates. |
| *interface-name* | (Optional) Interface on which the access list should be applied to incoming updates. If no interface is specified, the access list will be applied to all incoming updates. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

This command is not supported in IS-IS.

## Example

In the following example, the Enhanced IGRP routing process accepts only two networks—network 0.0.0.0 and network 131.108.0.0:

```
access-list 1 permit 0.0.0.0
access-list 1 permit 131.108.0.0
access-list 1 deny 0.0.0.0 255.255.255.255
router eigrp
network 131.108.0.0
distribute-list 1 in
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**access-list** †
**distribute-list out**
**redistribute**

# distribute-list out

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

**distribute-list** *access-list-number* **out** [*interface-name* | *routing-process* | *autonomous-system-number*]
**no distribute-list** *access-list-number* **out** [*interface-name* | *routing-process* | *autonomous-system-number*]

## Syntax Description

| | |
|---|---|
| *access-list-number* | Standard IP access list number. The list defines which networks are to be sent and which are to be suppressed in routing updates. |
| **out** | Applies the access list to outgoing routing updates. |
| *interface-name* | (Optional) Name of a particular interface. |
| *routing-process* | (Optional) Name of a particular routing process, or the keyword **static** or **connected**. |
| *autonomous-system-number* | (Optional) Autonomous system number. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

When redistributing networks, a routing process name can be specified as an optional trailing argument to the **distribute-list** command. This causes the access list to be applied to only those routes derived from the specified routing process. After the process-specific access list is applied, any access list specified by a **distribute-list** command without a process name argument will be applied. Addresses not specified in the **distribute-list** command will not be advertised in outgoing routing updates.

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

## Examples

The following example would cause only one network to be advertised by a RIP routing process: network 131.108.0.0.

```
access-list 1 permit 131.108.0.0
access-list 1 deny 0.0.0.0 255.255.255.255
router rip
network 131.108.0.0
distribute-list 1 out
```

In the following example, access list 1 is applied to outgoing routing updates and IS-IS is enabled on interface Ethernet 0. Only network 131.131.101.0 will be advertised in outgoing IS-IS routing updates.

```
router isis
redistribute ospf 109
distribute-list 1 out
interface Ethernet 0
ip router isis
access-list 1 permit 131.131.101.0 0.0.0.255
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**access-list** †
**distribute-list in**
**redistribute**

# domain-password

To configure the IS-IS routing domain authentication password, use the **domain-password** router configuration command. To disable a password, use the **no** form of this command.

**domain-password** *password*
**no domain-password** [*password*]

### Syntax Description

| | |
|---|---|
| *password* | Password you assign |

### Default

No password is specified.

### Command Mode

Router configuration

### Usage Guidelines

This password is inserted in Level 2 (area router level) link state PDUs (LSPs), complete sequence number PDUs (CSNPs), and partial sequence number PDUs (PSNP).

### Example

The following example assigns an authentication password to the routing domain:

```
router isis
domain-password flower
```

### Related Command

**area-password**

# ip address

To specify the IP address on an interface, use the **ip address** interface configuration command. To remove an address, use the **no** form of this command.

**ip address** *address mask* [**secondary**]
**no ip address** *address mask* [**secondary**]

## Syntax Description

| | |
|---|---|
| *address* | IP address |
| *mask* | IP address mask |
| **secondary** | (Optional) Address to be added as a secondary address |

## Default

Disabled

## Command Mode

Interface configuration

## Usage Guidelines

The optional keyword **secondary** allows an unlimited number of secondary addresses to be specified. Secondary addresses are treated like primary addresses, except that the system never generates datagrams other than routing updates with secondary source addresses. IP broadcasts and ARP requests are handled properly, as are interface routes in the IP routing table.

Secondary IP addresses can be used in a variety of situations. The following are the most common applications:

- There may not be enough host addresses for a particular network segment. For example, your subnetting allows up to 254 hosts per logical subnet, but on one physical subnet you need to have 300 host addresses. Using secondary IP addresses on the routers allows you to have two logical subnets using one physical subnet.
- Many older networks were built using Level 2 bridges. The judicious use of secondary addresses can aid in the transition to a subnetted, router-based network. Routers on an older, bridged segment can be easily made aware that there are many subnets on that segment.
- Two subnets of a single network might otherwise be separated by another network. This situation is not permitted when subnets are in use. In these instances, the first network is *extended*, or layered on top of the second network using secondary addresses.

---

**Note** If any router on a network segment uses a secondary address, all other routers on that same segment must also use a secondary address from the same network or subnet. An inconsistent use of secondary addresses on a network segment can very quickly lead to routing loops.

---

## Example

The following example specifies 131.108.1.27 as the primary address and 192.31.7.17 as a secondary address for interface Ethernet 0:

```
interface ethernet 0
ip address 131.108.1.27 255.255.255.0
ip address 192.31.7.17 255.255.255.0 secondary
```

# ip as-path access-list

To define a BGP-related access list, use the **ip as-path access-list** global configuration command. To disable use of the access list, use the **no** form of this command.

**ip as-path access-list** *access-list-number* {**permit** | **deny**} *as-regular-expression*
**no ip as-path access-list** *access-list-number* {**permit** | **deny**} *as-regular-expression*

## Syntax Description

| | |
|---|---|
| *access-list-number* | Integer from 1 to 199 that indicates the regular expression access list number. |
| **permit** | Permits access for matching conditions. |
| **deny** | Denies access to matching conditions. |
| *as-regular-expression* | Autonomous system in the access list using a regular expression. See the "Regular Expressions" appendix for information about forming regular expressions. |

## Default

No access lists are defined.

## Command Mode

Global configuration

## Usage Guidelines

You can specify an access list filter on both inbound and outbound BGP routes. In addition, you can assign *weights* based on a set of filters. Each filter is an access list based on regular expressions. If the regular expression matches the representation of the autonomous system path of the route as an ASCII string, then the **permit** or **deny** condition applies. The autonomous system path does not contain the local autonomous system number. Use the **ip as-path access-list** global configuration command to define an BGP access list, and the **neighbor** router configuration command to apply a specific access list.

See the "Regular Expressions" appendix for information on forming regular expressions.

## Example

The following example specifies that the BGP neighbor with IP address 128.125.1.1 is not sent advertisements about any path through or from the adjacent autonomous system 123.

```
ip as-path access-list 1 deny _123_
ip as-path access-list 1 deny ^123 .*
! The space in the above expression (^123.*) is required.

router bgp 109
network 131.108.0.0
neighbor 129.140.6.6 remote-as 123
neighbor 128.125.1.1 remote-as 47
neighbor 128.125.1.1 filter-list 1 out
```

## Related Commands

**neighbor distribute-list**
**neighbor filter-list**

# ip default-network

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

**ip default-network** *network-number*
**no ip default-network** *network-number*

## Syntax Description

| | |
|---|---|
| *network-number* | Number of the network |

## Default

If the router has a directly connected interface onto the specified network, the dynamic routing protocols running on that router will generate (or source) a default route. For RIP, this is flagged as the pseudonetwork 0.0.0.0; for IGRP, it is the network itself, flagged as an exterior route.

## Command Mode

Global configuration

## Usage Guidelines

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

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

## Examples

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

```
ip route 10.0.0.0 255.0.0.0 131.108.3.4
ip default-network 10.0.0.0
```

If the following command was issued on a router not connected to network 129.140.0.0, the router might choose the path to that network as a default route when the network appeared in the routing table:

```
ip default-network 129.140.0.0
```

## Related Command

**show ip route**

# ip dvmrp accept-filter

To configure an acceptance filter for incoming DVMRP reports, use the **ip dvmrp accept-filter** interface configuration command. To disable this feature, use the **no** form of this command.

**ip dvmrp accept-filter** *access-list-number* [*distance*]
**no ip dvmrp accept-filter** *access-list-number* [*distance*]

## Syntax Description

| | |
|---|---|
| *access-list-number* | Number of a standard IP access list. This can be a number from 0 to 99. A value of 0 means that all sources are accepted with the configured distance. |
| *distance* | (Optional) Administrative distance to the destination. |

## Default

All destinations are accepted with a distance of 0.

## Command Mode

Interface configuration

## Usage Guidelines

Any sources that match the access list are stored in the DVMRP routing table.

The route with the lower distance (either the route in the unicast routing table or that in the DVMRP routing table) takes precedence when computing the Reverse Path Forwarding (RPF) interface for a source of a multicast packet.

By default, the administrative distance for DVMRP routes is 0. This means that they always take precedence over unicast routing table routes. If you have two paths to a source, one through unicast routing (using PIM as the multicast routing protocol) and another path using DVMRP (unicast and multicast routing), and if you want to use the PIM path, use the **ip dvmrp accept-filter** command to increase the administrative distance for DVMRP routes. For example, if the unicast routing protocol is Enhanced IGRP, which has a default administrative distance of 90, you could define and apply the following access list so the RPF interface used to accept multicast packets will be through the Enhanced IGRP/PIM path:

```
ip dvmrp accept-filter 1 100
access-list 1 permit 0.0.0.0 255.255.255.255
```

## Example

The following example applies access list 57 to the interface and sets a distance of 4:

```
access-list 57 permit 131.108.0.0 0.0.255.255
access-list 57 permit 198.92.37.0 0.0.0.255
access-list 57 deny 0.0.0.0 255.255.255.255
ip dvmrp accept-filter 57 4
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**distance**
**ip dvmrp metric**
**show ip dvmrp route**
**tunnel mode** †

# ip dvmrp metric

To configure the metric associated with a set of destinations for DVMRP reports, use the **ip dvmrp metric** interface configuration command. To disable this function, use the **no** form of this command.

**ip dvmrp metric** *metric* [*access-list-number*] [*protocol process-id*]
**no ip dvmrp metric** *metric* [*access-list-number*] [*protocol process-id*]

## Syntax Description

| | |
|---|---|
| *metric* | Metric associated with a set of destinations for DVMRP reports. It can be a value from 0 to 32. A value of 0 means that the route is not advertised. A value of 32 is equivalent to infinity (unreachable). |
| *access-list-number* | (Optional) Number of an access list. If you specify this argument, only the multicast destinations that match the access list are reported with the configured metric. Any destinations not advertised because of split horizon do not use the configured metric. |
| *protocol* | (Optional) Name of unicast routing protocol. It can be **bgp**, **egp**, **eigrp**, **igrp**, **isis**, **ospf**, **rip**, or **static**. (Note that these are the protocol names you can specify with a **router** *protocol* command.)<br>If you specify these arguments, only routes learned by the specified routing protocol are advertised in DVMRP report messages. |
| *process-id* | (Optional) Process ID number of the unicast routing protocol. |

## Default

No metric is preconfigured. Only directly connected subnets and networks are advertised to neighboring DVMRP routers.

## Command Mode

Interface configuration

## Usage Guidelines

When PIM is configured on an interface and DVMRP neighbors are discovered, the router sends DVMRP report messages for directly connected networks. The **ip dvmrp metric** command enables DVMRP report messages for multicast destinations that match the access list. Usually, the metric for these routes is 1. Under certain circumstances, it may be desirable to tailor the metric used for various unicast routes.

Use the *access-list-number* argument in conjunction with the *protocol process-id* arguments to selectively list the destinations learned from a given routing protocol.

To display DVMRP activity, use the **debug ip dvmrp** command.

## Example

The following example connects a PIM cloud to a DVMRP cloud. Access list 1 permits the sending of DVMRP reports to the DVMRP routers advertising all sources in the 198.92.35.0 network with a metric of 1. Access list 2 permits all other destinations, but the metric of 0 means that no DVMRP reports are sent for these destinations.

```
access-list 1 permit 198.92.35.0 0.0.0.255
access-list 1 deny 0.0.0.0 255.255.255.255
access-list 2 permit 0.0.0.0 255.255.255.255
interface tunnel 0
ip dvmrp metric 1 1
ip dvmrp metric 0 2
```

## Related Commands

Two daggers (††) indicate that the command is documented in the *Debug Command Reference* publication.

**debug ip dvmrp** ††
**ip dvmrp accept-filter**

# ip gdp

To enable GDP routing on an interface, use the **ip gdp** interface configuration command. To disable GDP routing, use the **no** form of this command.

**ip gdp** [**priority** *number* | **reporttime** *seconds* | **holdtime** *seconds*]
**no ip gdp**

## Syntax Description

| | |
|---|---|
| **priority** *number* | (Optional) Alters the GDP priority; default is a priority of 100. A larger number indicates a higher priority. |
| **reporttime** *seconds* | (Optional) Alters the GDP reporting interval; the default is 5 seconds for broadcast media such as Ethernets, and never for nonbroadcast media such as X.25. |
| **holdtime** *seconds* | (Optional) Alters the GDP default hold time of 15 seconds. |

## Default

**priority**: 100
**reporttime**: 5 seconds for broadcast media; 0 for nonbroadcast media
**holdtime**: 15 seconds

## Command Mode

Interface configuration

## Usage Guidelines

When enabled on an interface, GDP updates report the primary and secondary IP addresses of that interface.

## Example

In the following example, GDP is enabled on interface Ethernet 1 with a report time of 10 seconds, and priority and hold time set to their defaults (because none are specified):

```
ip gdp reporttime 10
```

# ip hello-interval eigrp

To configure the hello interval for the Enhanced IGRP routing process designated by an autonomous system number, use the **ip hello-interval eigrp** interface configuration command. To restore the default value, use the **no** form of this command.

**ip hello-interval eigrp** *autonomous-system-number seconds*
**no ip hello-interval eigrp** *autonomous-system-number seconds*

## Syntax Description

| | |
|---|---|
| *autonomous-system-number* | Autonomous system number |
| *seconds* | Hello interval, in seconds |

## Default

5 seconds

## Command Mode

Interface configuration

## Example

The following example sets the hello interval for interface Ethernet 0 to 10 seconds:

```
interface ethernet 0
ip hello-interval eigrp 109 10
```

## Related Command

**ip hold-time eigrp**

# ip hold-time eigrp

To configure the hold time for the Enhanced IGRP routing process designated by the autonomous system number, use the **ip hold-time eigrp** interface configuration command. To restore the default value, use the **no** form of this command.

**ip hold-time eigrp** *autonomous-system-number seconds*
**no ip hold-time eigrp** *autonomous-system-number seconds*

## Syntax Description

| | |
|---|---|
| *autonomous-system-number* | Autonomous system number |
| *seconds* | Hold time, in seconds |

## Default

15 seconds

## Command Mode

Interface configuration

## Usage Guidelines

The hold time is three times the hello interval. If the current value for the hold time is less than two times the hello interval, the hold time is reset.

If a router does not receive a hello packet within the specified hold time, routes through the router are considered available.

Increasing the hold time delays route convergence across the network.

## Example

The following example sets the hold time for Ethernet interface 0 to 40 seconds:

```
interface ethernet 0
ip hold-time eigrp 109 40
```

## Related Command

**ip hello-interval eigrp**

# ip igmp access-group

To control the multicast groups that hosts on the subnet serviced by an interface can join, use the **ip igmp access-group** interface configuration command. To disable groups on an interface, use the **no** form of this command.

**ip igmp access-group** *access-list-number*
**no ip igmp access-group** *access-list-number*

## Syntax Description

| | |
|---|---|
| *access-list-number* | Number of a standard IP access list. This can be a number from 1 to 99. |

## Default

All groups are allowed on an interface.

## Command Mode

Interface configuration

## Example

In the following example, host services by Ethernet interface 0 can join the group 225.2.2.2 only:

```
access-list 1 225.2.2.2 0.0.0.0
interface ethernet 0
ip igmp access-group 1
```

## Related Command

**ip igmp join-group**

# ip igmp join-group

To have the router join a multicast group, use the **ip igmp join-group** interface configuration command. To cancel membership in a multicast group, use the **no** form of this command.

**ip igmp join-group** *group-address*
**no ip igmp join-group** *group-address*

## Syntax Description

| | |
|---|---|
| *group-address* | Address of the multicast group. This is a multicast IP address in four-part dotted notation. |

## Default

No multicast group memberships are predefined.

## Command Mode

Interface configuration

## Usage Guidelines

IP packets that are addressed to the group address are passed to the IP client process in the router.

If all the multicast-capable routers that you administer are members of a multicast group, pinging that group causes all routers to respond. This can be a useful administrative and debugging tool.

Another reason to have a router join a multicast group is when other hosts on the network have a bug in IGRP that prevents them from correctly answering IGMP queries. Having the router join the multicast group causes upstream routers to maintain multicast routing table information for that group and keep the paths for that group active.

## Example

In the following example, the router joins multicast group 225.2.2.2:

```
ip igmp join-group 225.2.2.2
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**ip igmp access-group**
**ping** †

# ip igmp query-interval

To configure the frequency at which the router sends IGMP host-query messages, use the **ip igmp query-interval** interface configuration command. To return to the default frequency, use the **no** form of this command.

**ip igmp query-interval** *seconds*
**no ip igmp query-interval**

## Syntax Description

| | |
|---|---|
| *seconds* | Frequency, in seconds, at which to transmit IGMP host-query messages. The can be a number from 0 to 65535. The default is 60 seconds. |

## Default

60 seconds

## Command Mode

Interface configuration

## Usage Guidelines

Multicast routers send host membership query messages (referred to as host-query messages) to discover which multicast groups have members on the router's attached networks. Hosts respond with IGMP report messages indicating that they wish to receive multicast packets for specific groups (that is, indicating that the host wants to become a member of the group). Host-query messages are addresses to the all-hosts multicast group, which has the address 224.0.0.1, and have an IP TTL value of 1.

The designated router for a LAN is the only router that sends IGMP host-query messages. The designated router is elected according to the multicast routing protocol that runs on the LAN.

---

**Note** Changing this value may severely impact multicast forwarding.

---

## Example

The following example changes the frequency at which the designated router sends IGMP host-query messages to 2 minutes:

```
interface tunnel 0
ip igmp query-interval 120
```

## Related Commands

**ip pim query-interval**
**show ip igmp groups**

# ip irdp

To enable ICMP Router Discovery Protocol (IRDP) processing on an interface, use the **ip irdp** interface configuration command. To disable IRDP routing, use the **no** form of this command.

**ip irdp** [**multicast | holdtime** *seconds* **| maxadvertinterval** *seconds* **| minadvertinterval** *seconds* **| preference** *number* **| address** *address* [*number*]]
**no ip irdp**

## Syntax Description

| | |
|---|---|
| **multicast** | (Optional) Use the multicast address (224.0.0.1) instead of IP broadcasts. |
| **holdtime** *seconds* | (Optional) Length of time in seconds advertisements are held valid. Default is three times the **maxadvertinterval** value. Must be greater than **maxadvertinterval** and cannot be greater than 9000 seconds. |
| **maxadvertinterval** *seconds* | (Optional) Maximum interval in seconds between advertisements. The default is 600 seconds. |
| **minadvertinterval** *seconds* | (Optional) Minimum interval in seconds between advertisements. The default is 0.75 times the **maxadvertinterval**. If you change the **maxadvertinterval** value, this value defaults to three-quarters of the new value. |
| **preference** *number* | (Optional) Router's preference value. The allowed range is $-2^{31}$ to $2^{31}$. The default is 0. A higher value increases the router's preference level. You can modify a particular router so that it will be the preferred router to which others home. |
| **address** *address* [*number*] | (Optional) IP address (*address*) to proxy-advertise, and optionally, its preference value (*number*). |

## Default

Disabled.

When enabled, IRDP uses these defaults:

- Broadcast IRDP advertisements
- Maximum interval between advertisements: 600 seconds
- Minimum interval between advertisements: 0.75 times **maxadvertinterval**
- Preference: 0

## Command Mode

Interface configuration

## Usage Guidelines

If you change **maxadvertinterval**, the other two values also change, so it is important to change **maxadvertinterval** first before changing either **holdtime** or **minadvertinterval**.

The **ip irdp multicast** command allows for compatibility with Sun Microsystems Solaris, which requires IRDP packets to be sent out as multicasts. Many implementations cannot receive these multicasts; ensure end host ability before using this command.

## Example

The following example illustrates how to set the various IRDP processes:

```
! enable irdp on interface Ethernet 0
interface ethernet 0
ip irdp
! send IRDP advertisements to the multicast address
ip irdp multicast
! increase router preference from 100 to 50
ip irdp preference 50
! set maximum time between advertisements to 400 secs
ip irdp maxadvertinterval 400
! set minimum time between advertisements to 100 secs
ip irdp minadvertinterval 100
! advertisements are good for 6000 seconds
ip irdp holdtime 6000
! proxy-advertise 131.108.14.5 with default router preference
ip irdp address 131.108.14.5
! proxy-advertise 131.108.14.6 with preference of 50
ip irdp address 131.108.14.6 50
```

# ip multicast-routing

To enable IP multicast routing on the router, use the **ip multicast-routing** global configuration command. To disable IP multicast routing, use the **no** form of this command.

**ip multicast-routing**
**no ip multicast-routing**

### Syntax Description

This command has no arguments or keywords.

### Default

IP multicast routing is disabled.

### Command Mode

Global configuration

### Usage Guidelines

When IP multicast routing is disabled, the router does not forward any multicast packets.

### Example

The following example enables IP multicast routing on the router:

```
ip multicast-routing
```

### Related Command

**ip pim**

# ip multicast-threshold

To configure the time-to-live (TTL) threshold of packets being forwarded out an interface, use the **ip multicast-threshold** interface configuration command. To return to the default TTL threshold, use the **no** form of this command.

**ip multicast-threshold** *ttl*
**no ip multicast-threshold** [*ttl*]

## Syntax Description

| | |
|---|---|
| *ttl* | Time-to-live value, in hops. It can be a value from 0 to 255. The default value is 0, which means that all multicast packets are forwarded out the interface. |

## Default

0, which means that all multicast packets are forwarded out the interface.

## Command Mode

Interface configuration

## Usage Guidelines

Any multicast packets with a TTL value less than the threshold are not forwarded out the interface.

You should configure the TTL threshold only on border routers. Conversely, routers on which you configure a TTL threshold value automatically become border routers.

## Example

In the following example, you set the TTL threshold on a border router to 200, which is a very high value. This means that multicast packets must have a TTL greater than 200 in order to be forwarded out this interface. Multicast applications generally set this value well below 200. Therefore, setting a value of 200 means that no packets will be forwarded out the interface.

```
interface tunnel 0
ip multicast-threshold 200
```

# ip ospf authentication-key

To assign a password to be used by neighboring routers that are using OSPF's simple password authentication, use the **ip ospf authentication-key** interface configuration command. To remove a previously assigned OSPF password, use the **no ip** form of this command.

**ip ospf authentication-key** *password*
**no ip ospf authentication-key**

## Syntax Description

| | |
|---|---|
| *password* | Any continuous string of characters that can be entered from the keyboard up to 8 bytes in length. |

## Default

No password is specified.

## Command Mode

Interface configuration

## Usage Guidelines

The password created by this command is used as a "key" that is inserted directly into the OSPF header when the router originates routing protocol packets. A separate password can be assigned to each network on a per-interface basis. All neighboring routers on the same network must have the same password to be able to exchange OSPF information.

---

**Note** A router will use this key only when authentication is enabled for an area with the **area authentication** router configuration command.

---

## Example

In the following example, the authentication key is enabled with the string *yourpass*:

```
ip ospf authentication-key yourpass
```

## Related Command

**area authentication**

# ip ospf cost

To explicitly specify the cost of sending a packet on an interface, use the **ip ospf cost** interface configuration command. To reset the path cost to the default value, use the **no** form of this command.

**ip ospf cost** *cost*
**no ip cost**

## Syntax Description

| | |
|---|---|
| *cost* | Unsigned integer value expressed as the link state metric. It can be a value in the range 1 to 65535. |

## Default

No default cost is predefined.

## Command Mode

Interface configuration

## Usage Guidelines

Unlike IGRP, you must set this metric manually using this command, if you need to change the default. Changing the bandwidth does not change the link cost.

The link state metric is advertised as the link cost in the router's router link advertisement. We do not support type of service (TOS), so you can assign only one cost per interface.

In general, the path cost is calculated using the following formula:

$10^8$ *Bandwidth*

Using the above formula, the default path costs were calculated as noted in the following list. If these values do not suit your network, you can use your own method of calculating path costs.

- 56-kbps serial link—Default cost is 1785
- 64-kbps serial link—Default cost is 1562
- T1 (1.544-Mbps serial link)—Default cost is 65
- E1 (2.048-Mbps serial link)—Default cost is 48
- 4-Mbps Token Ring—Default cost is 25
- Ethernet—Default cost is 10
- 16-Mbps Token Ring—Default cost is 6
- FDDI—Default cost is 1

## Example

The following example sets the interface cost value to 65:

```
ip ospf cost 65
```

# ip ospf dead-interval

To set how long a router's Hello packets must not have been seen before its neighbors declare the router down, use the **ip ospf dead-interval** interface configuration command. To return to the default time, use the **no** form of this command.

**ip ospf dead-interval** *seconds*
**no ip ospf dead-interval**

## Syntax Description

| | |
|---|---|
| *seconds* | Unsigned integer that specifies the interval in seconds; the value must be the same for all nodes on the network. |

## Default

Four times the interval set by the **ip ospf hello-interval** command

## Command Mode

Interface configuration

## Usage Guidelines

The interval is advertised in the router's Hello packets. This value must be the same for all routers on a specific network.

## Example

The following example sets the OSPF dead interval to 60 seconds:

```
interface ethernet 1
ip ospf dead-interval 60
```

## Related Command

**ip ospf hello-interval**

# ip ospf hello-interval

To specify the interval between Hello packets that the router sends on the interface, use the **ip ospf hello-interval** interface configuration command. To return to the default time, use the **no** form of this command.

**ip ospf hello-interval** *seconds*
**no ip ospf hello-interval**

## Syntax Description

| | |
|---|---|
| *seconds* | Unsigned integer that specifies the interval in seconds. The value must be the same for all nodes on a specific network. |

## Default

10 seconds

## Command Mode

Interface configuration

## Usage Guidelines

This value is advertised in the router's Hello packets. The smaller the Hello interval, the faster topological changes will be detected, but more routing traffic will ensue. This value must be the same for all routers on a specific network.

## Example

The following example sets the interval between Hello packets to 15 seconds:

```
interface ethernet 1
ip ospf hello-interval 15
```

## Related Command

**ip ospf dead-interval**

# ip ospf-name-lookup

To configure OSPF to look up Domain Name System (DNS) names for use in all OSPF **show** EXEC command displays, use the **ip ospf-name-lookup** global configuration command. To disable this feature , use the **no** form of this command.

**ip ospf-name-lookup**
**no ip ospf-name-lookup**

## Syntax Description

This command has no arguments or keywords.

## Default

Disabled

## Command Mode

Global configuration

## Usage Guidelines

This feature makes it easier to identify a router because it is displayed by name rather than by its router ID or neighbor ID.

## Example

The following example configures OSPF to look up DNS names for use in all OSPF **show** EXEC command displays:

```
ip ospf-name-lookup
```

## Sample Display

The following is sample output of the **show ip ospf database** EXEC command, for example, once you have enabled the DNS name lookup feature.

```
Router# show ip ospf database

       OSPF Router with id (160.89.41.1) (Autonomous system 109)


                Router Link States (Area 0.0.0.0)

Link ID         ADV Router      Age    Seq#       Checksum Link count
160.89.41.1     router          381    0x80000003 0x93BB   4
160.89.34.2     neon            380    0x80000003 0xD5C8   2

                Net Link States (Area 0.0.0.0)

Link ID         ADV Router      Age    Seq#       Checksum
160.89.32.1     router          381    0x80000001 0xC117
```

# ip ospf network

To configure the OSPF network type to a type other than the default for a given media, use the **ip ospf network** interface configuration command. To return to the default value, use the **no** form of this command.

**ip ospf network** {**broadcast** | **non-broadcast**}
**no ip ospf network**

### Syntax Description.

| | |
|---|---|
| **broadcast** | Sets the network type to broadcast. |
| **non-broadcast** | Sets the network type to nonbroadcast. |

### Default

Depends on the network type

### Command Mode

Interface configuration

### Usage Guidelines

Using this feature, you can configure broadcast networks as nonbroadcast multiaccess networks when, for example, you have routers in your network that do not support multicast addressing. You can also configure nonbroadcast multiaccess networks, such as X.25, Frame Relay, and SMDS, as broadcast networks. This feature saves you from having to configure neighbors.

If this command is issued on an interface that does not allow it, it will be ignored.

### Example

The following example sets your OSPF network as a broadcast network:

```
interface serial 0
ip address 160.89.77.17 255.255.255.0
ip ospf network broadcast
encapsulation frame-relay
```

### Related Commands

**neighbor** (OSPF)
**x25-map**
**frame-relay map**

# ip ospf priority

To set the router's priority, which helps determine the designated router for this network, use the **ip ospf priority** interface configuration command. To return to the default value, use the **no** form of this command.

**ip ospf priority** *number*
**no ip ospf priority**

## Syntax Description

| | |
|---|---|
| *number* | 8-bit unsigned integer that specifies the priority. The range is from 0 to 255. |

## Default

Priority of 1

## Command Mode

Interface configuration

## Usage Guidelines

When two routers attached to a network both attempt to become the designated router; the one with the higher router priority takes precedence. If there is a tie, the router with the higher router ID takes precedence. A router with a router priority set to zero is ineligible to become the designated router or backup designated router. Router priority is only configured for interfaces to multiaccess networks (in other words, not point-to-point networks).

This priority value is used when you configure OSPF for nonbroadcast networks using the **neighbor** router configuration command for OSPF.

## Example

The following example sets the router priority value to 4:

```
interface ethernet 0
ip ospf priority 4
```

## Related Commands

**ip ospf network**
**neighbor** (OSPF)

# ip ospf retransmit-interval

To specify the time between link state advertisement retransmissions for adjacencies belonging to the interface, use the **ip ospf retransmit-interval** interface configuration command. To return to the default value, use the **no** form of this command.

**ip ospf retransmit-interval** *seconds*
**no ip ospf retransmit-interval**

## Syntax Description

| | |
|---|---|
| *seconds* | Time in seconds between retransmissions. It must be greater than the expected round-trip delay between any two routers on the attached network. The range is 1 to 65535 seconds. The default is 5 seconds. |

## Default

5 seconds

## Command Mode

Interface configuration

## Usage Guidelines

When a router sends a link state advertisement (LSA) to its neighbor, it keeps the LSA until it receives back the acknowledgment. If it receives no acknowledgment in *seconds*, it will retransmit the LSA.

The setting of this parameter should be conservative, or needless retransmission will result. The value should be larger for serial lines and virtual links.

## Example

The following example sets the retransmit-interval value to 8 seconds:

```
interface ethernet 2
ip ospf retransmit-interval 8
```

# ip ospf transmit-delay

To set the estimated time it takes to transmit a link state update packet on the interface, use the **ip ospf transmit-delay** interface configuration command. To return to the default value, use the **no** form of this command.

**ip ospf transmit-delay** *seconds*
**no ip ospf transmit-delay**

## Syntax Description

| | |
|---|---|
| *seconds* | Time in seconds that it takes to transmit a link state update. It can be an integer in the range is 1 to 65535 seconds. The default is 1 second. |

## Default

1 second

## Command Mode

Interface configuration

## Usage Guidelines

Link state advertisements in the update packet must have their age incremented by the amount specified in the *seconds* argument before transmission. The value assigned should take into account the transmission and propagation delays for the interface.

If the delay is not added before transmission over a link, the time in which the LSA propagates over the link is not considered. This setting has more significance on very low speed links.

## Example

The following example sets the retransmit-delay value to 3 seconds:

```
interface ethernet 0
ip ospf transmit-delay 3
```

# ip pim

To enable PIM on an interface, use the **ip pim** interface configuration command. To disable PIM on the interface, use the **no** form of this command.

**ip pim** {**dense-mode** | **sparse-mode**}
**no ip pim** [**dense-mode** | **sparse-mode**]

## Syntax Description

| | |
|---|---|
| **dense-mode** | Enables dense mode of operation. |
| **sparse-mode** | Enables sparse mode of operation. |

## Default

IP multicast routing is disabled on all interfaces.

There is no default mode setting.

## Command Mode

Interface configuration

## Usage Guidelines

Enabling PIM on an interface also enables IGMP operation on that interface. An interface can be configured to be in dense mode or sparse mode. The mode describes how the router populates its multicast routing table and how the router forwards multicast packets it receives from its directly connected LANs. In populating the multicast routing table, dense-mode interfaces are always added to the table. Sparse-mode interfaces are added to the table only when periodic join messages are received from downstream routers or there is a directly connected member on the interface.

Initially, a dense-mode interface forwards multicast packets until the router determines that there are group members or downstream routers, or until a prune message is received from a downstream router. Then, the dense-mode interface will periodically forward multicast packets out the interface until the same conditions occur. Dense mode assumes that there are multicast group members present. Dense-mode routers never send a join message. They do send prune messages as soon as they determine they have no members or downstream PIM routers.

A sparse-mode interface is used only for multicast forwarding if a join message is received from a downstream router or if there are group members directly connected to the interface. Sparse mode assumes that there are no other multicast group members present. When sparse-mode routers want to join the shared path, they periodically send join messages toward the RP. When sparse-mode routers want to join the source path, they periodically send join messages toward the source; they also send periodic prune messages toward to RP to prune the shared path.

## Examples

The following commands enables sparse-mode PIM on tunnel interface 0 and sets the address of the RP router to 226.0.0.8:

```
interface tunnel 0
ip pim sparse-mode
ip pim rp-address 226.0.0.8
```

The following commands enable dense-mode PIM on Ethernet interface 1:

```
interface ethernet 1
ip pim dense-mode
```

## Related Commands

**ip multicast-routing**
**ip pim rp-address**
**show ip igmp interface**

# ip pim query-interval

To configure the frequency of PIM router-query messages, use the **ip pim query-interval** interface configuration command. To return to the default interval, use the **no** form of this command.

**ip pim query-interval** *seconds*
**no ip pim query-interval** [*seconds*]

## Syntax Description

| | |
|---|---|
| *seconds* | Interval, in seconds, at which periodic PIM router-query messages are sent. It can be a number from 1 to 65535. The default is 30 seconds. |

## Default

30 seconds

## Command Mode

Interface configuration

## Usage Guidelines

Routers that are configured for IP multicast send PIM router-query messages to determine which router will be the designated router for each LAN segment (subnet). The designated router is responsible for sending IGMP host-query messages to all hosts on the directly connected LAN. When operating in sparse mode, the designated router is responsible for sending source registration messages to the RP. The designated router is the router with the largest IP address.

## Example

The following example changes the PIM router-query message interval to 45 seconds:

```
interface tunnel 0
ip pim query-interval 45
```

## Related Commands

**ip igmp query-interval**

# ip pim rp-address

To configure the address of a PIM rendezvous point (RP), use the **ip pim rp-address** global configuration command. To remove an RP address, use the **no** form of this command.

**ip pim rp-address** *ip-address* [*access-list-number*]
**no ip pim rp-address** *ip-address* [*access-list-number*]

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of a router to be a PIM RP. This is a unicast IP address in four-part dotted notation. |
| *access-list-number* | (Optional) Number of an access list that defines which multicast groups the RP should be used for. This is a standard IP access list. The number can be from 1 to 100. |

## Default

No PIM RPs are preconfigured.

## Command Mode

Global configuration

## Usage Guidelines

You must configure the IP address of RPs in leaf routers only. Leaf routers are those routers that are directly connected either to a multicast group member or to a sender of multicast messages.

The RP address is used by first-hop routers to send register packets on behalf of source multicast hosts to the RP. This address is also used by routers on behalf of multicast hosts that want to become members of a group to send join messages towards the RP. The RP must be a PIM router; however, it does not require any special configuration to recognize that it is the RP. Also, RPs are not members of the multicast group; rather, they serve as a "meeting place" for multicast sources and group members.

Choosing the router that will be an RP requires prior coordination between the people who want to be members of the multicast group. You should examine the length of the paths between members and sources. Remember that most multicast members will eventually want to join to the source tree that is the shortest route between the source and the group member.

You can configure a router to use a single RP for more than one group. The conditions specified by the access list determine which groups the RP can be used for. If no access list is configured, the RP is used for all groups.

A PIM router can use multiple RPs.

First-hop routers for multicast sources send register packets to all configured RPs. First-hop routers for multicast group members send join packets to one RP at a time. Once this router begins receiving multicast packets for the group, it will have joined one RP tree. Because the router does not want to receive multiple copies of the same packet, it joins only one RP tree.

## Examples

The following example sets the PIM RP address to 198.92.37.33 for all multicast groups:

```
ip pim rp-address 198.92.37.33
```

The following example sets the PIM RP address to 147.106.6.22 for the multicast group 225.2.2.2 only:

```
access list 1 225.2.2.2 0.0.0.0
pi pim rp-address 147.106.6.22 1
```

## Related Command

A dagger (†) indicates that the command is documented in another chapter.

**access-list** †

# ip route

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

**ip route** *network* [*mask*] {*address* | *interface*} [*distance*]
**no ip route**

## Syntax Description

| | |
|---|---|
| *network* | IP address of the target network or subnet |
| *mask* | (Optional) Network mask that lets you mask network and subnetwork bits |
| *address* | IP address of the next hop that can be used to reach that network |
| *interface* | Network interface to use |
| *distance* | (Optional) An administrative distance |

## Default

No static routes are established.

## Command Mode

Global configuration

## Usage Guidelines

A static route is appropriate when the router cannot dynamically build a route to the destination.

If you specify an administrative distance, you are flagging a static route that can be overridden by dynamic information. For example, IGRP-derived routes have a default administrative distance of 100. To have a static route that would be overridden by an IGRP dynamic route, specify an administrative distance greater than 100. Static routes have a default administrative distance of 1.

Static routes that point to an interface will be advertised via RIP, IGRP, and other dynamic routing protocols, regardless of whether **redistribute static** commands were specified for those routing protocols. This is because static routes that point to an interface are considered in the routing table to be connected and hence lose their static nature. However, if you define a static route to an interface that is not one of the networks defined in a **network** command, no dynamic routing protocols will advertise the route unless a **redistribute static** command is specified for these protocols.

## Examples

In the following example, an administrative distance of 110 was chosen. In this case, packets for network 10.0.0.0 will be routed through to the router at 131.108.3.4 if dynamic information with administrative distance less than 110 is not available.

```
ip route 10.0.0.0 255.0.0.0 131.108.3.4 110
```

In the following example, packets for network 131.108.0.0 will be routed to the router at 131.108.6.6:

```
ip route 131.108.0.0 255.255.0.0 131.108.6.6
```

# ip router isis

To configure an IS-IS routing process for IP on an interface, use the **ip router isis** interface configuration command. To disable IS-IS for IP, use the **no** form of this command.

**ip router isis** [*tag*]
**no ip router isis** [*tag*]

### Syntax Description

| | |
|---|---|
| *tag* | (Optional) Defines a meaningful name for a routing process. If not specified, a null tag is assumed. It must be unique among all IP router processes for a given router. Use the same text for the argument *tag* as specified in the **router isis** global configuration command. |

### Default

No routing processes are specified.

### Command Mode

Interface configuration

### Example

The following example specifies IS-IS as an IP routing protocol for a process named Finance, and specifies that the Finance process will be routed on interfaces Ethernet 0 and serial 0:

```
router isis Finance
interface Ethernet 0
ip router isis Finance
interface serial 0
ip router isis Finance
```

### Related Command

**router isis**

# ip split-horizon

To enable the split-horizon mechanism, use the **ip split-horizon** interface configuration command. To disable the split-horizon mechanism, use the **no** form of this command.

**ip split-horizon**
**no ip split-horizon**

## Syntax Description

This command has no arguments or keywords.

## Default

Varies with media

## Command Mode

Interface configuration

## Usage Guidelines

For all interfaces except those for which either Frame Relay or SMDS encapsulation is enabled, the default condition for this command is **ip split-horizon**; in other words, the split horizon feature is active. If the interface configuration includes either the **encapsulation frame-relay** or **encapsulation smds** interface configuration commands, then the default is for split horizon to be disabled. Split horizon is not disabled by default for interfaces using any of the X.25 encapsulations.

---

**Note** For networks that include links over X.25 PSNs, the **neighbor** router configuration command can be used to defeat the split horizon feature. You can as an alternative *explicitly* specify the **no ip split-horizon** command in your configuration. However, if you do so you *must* similarly disable split horizon for all routers in any relevant multicast groups on that network.

---

If split horizon has been disabled on an interface and you wish to enable it, use the **ip split-horizon** command to restore the split horizon mechanism.

---

**Note** In general, changing the state of the default for the **ip split-horizon** command is not recommended, unless you are certain that your application requires making a change in order to properly advertise routes. Remember: If split horizon is disabled on a serial interface (and that interface is attached to a packet-switched network), you *must* disable split horizon for all routers in any relevant multicast groups on that network.

---

## Example

The following example illustrates a simple example of disabling split horizon on a serial link. In this example, the serial link is connected to an X.25 network:

```
interface serial 0
encapsulation x25
no ip split-horizon
```

## Related Command

**ip split-horizon eigrp neighbor**

# ip split-horizon eigrp

To enable Enhanced IGRP split horizon, use the **ip split-horizon eigrp** interface configuration command. To disable split horizon, use the **no** form of this command.

**ip split-horizon eigrp** *autonomous-system-number*
**no ip split-horizon eigrp** *autonomous-system-number*

## Syntax Description

| | |
|---|---|
| *autonomous-system-number* | Autonomous system number |

## Default

Enabled

## Command Mode

Interface configuration

## Usage Guidelines

For networks that include links over X.25 PSNs, you can use the **neighbor** router configuration command to defeat the split horizon feature. As an alternative, you can explicitly specify the **no ip split-horizon eigrp** command in your configuration. However, if you do so, you must similarly disable split horizon for all routers in any relevant multicast groups on that network.

In general, it is recommended that you not change the default state of split horizon unless you are certain that your application requires the change in order to properly advertise routes. Remember that if split horizon is disabled on a serial interface and that interface is attached to a packet-switched network, you must disable split horizon for all routers in any relevant multicast groups on that network.

## Example

The following example disables split horizon on a serial link connected to an X.25 network:

```
interface serial 0
encapsulation x25
no ip split-horizon eigrp
```

## Related Command

**ip split-horizon**
**neighbor**

# ip summary-address eigrp

To configure a summary aggregate address for a specified interface, use the **ip summary-address eigrp** interface configuration command. To disable a configuration, use the **no** form of this command.

**ip summary-address eigrp** *autonomous-system-number address mask*
**no ip summary-address eigrp** *autonomous-system-number address mask*

## Syntax Description

| | |
|---|---|
| *autonomous-system-number* | Autonomous system number |
| *address* | IP summary aggregate address to apply to an interface |
| *mask* | Subnet mask |

## Default

No summary aggregate addresses are predefined.

## Command Mode

Interface configuration

## Usage Guidelines

Enhanced IGRP summary routes are given an administrative distance value of 5. You cannot configure this value.

## Example

The following example sets the IP summary aggregate address for Ethernet interface 0:

```
interface ethernet 0
ip summary-address eigrp 109 192.1.0.0 255.255.0.0
```

## Related Command

**auto-summary**

# is-type

To configure the IS-IS level at which the router operates, use the **is-type** router configuration command. To reset the default value, use the **no** form of this command.

**is-type** {**level-1** | **level-1-2** | **level-2-only**}
**no is-type** {**level-1** | **level-1-2** | **level-2-only**}

## Syntax Description

| | |
|---|---|
| **level-1** | Router acts as a station router. |
| **level-1-2** | Router acts as both a station router and an area router. |
| **level-2-only** | Router acts as an area router only. |

## Default

Router acts as both a station router and an area router.

## Command Mode

Router configuration

## Example

The following example specifies an area router:

```
router isis
is-type level-2-only
```

# isis circuit-type

To configure the type of adjacency, use the **isis circuit-type** interface configuration command. To reset the circuit type to Level l and Level 2, use the **no** form of this command.

**isis circuit-type** {**level-1** | **level-1-2** | **level-2-only**}
**no isis circuit-type**

## Syntax Description

| | |
|---|---|
| **level-1** | A Level 1 adjacency may be established if there is at least one area address in common between this system and its neighbors. |
| **level-1-2** | A Level 1 and Level 2 adjacency is established if the neighbor is also configured as **level-1-2** and there is at least one area in common. If there is no area in common, a Level 2 adjacency is established. This is the default. |
| **level-2-only** | A Level 2 adjacency is established if and only if the neighbor is configured exclusively to be a Level 2 router. |

## Default

A Level 1 and Level 2 adjacency is established.

## Command Mode

Interface configuration

## Example

In the following example, a router is configured to require Level 1 adjacency if there is at least one area address in common between this system and its neighbors:

```
ip router isis
interface serial 0
isis circuit-type level-1
```

# isis csnp-interval

To configure the IS-IS complete sequence number PDUs (CSNP) interval, use the **isis csnp-interval** interface configuration command. To restore the default value, use the **no** form of this command.

**isis csnp-interval** *seconds* {**level-1** | **level-2**}
**no isis csnp-interval** {**level-1** | **level-2**}

## Syntax Description

| | |
|---|---|
| *seconds* | Interval of time between transmission of CSNPs on multiaccess networks. This interval only applies for the designated router. The default is 10 seconds. |
| **level-1** | Configures the interval of time between transmission of CSNPs for Level 1 independently. |
| **level-2** | Configures the interval of time between transmission of CSNPs for Level 2 independently. |

## Default

10 seconds

## Command Mode

Interface configuration

## Usage Guidelines

This command only applies for the designated router (DR) for a specified interface. Only DRs send CSNP packets in order to maintain database synchronization. The CSNP interval can be configured independently for Level 1 and Level 2. This feature does not apply to serial point-to-point interfaces. It does apply to WAN connections if the WAN is viewed as a multiaccess meshed network.

## Example

In the following example, interface serial 0 is configured for transmitting CSN PDUs every 5 seconds. The router is configured to act as a station router.

```
interface serial 0
isis csnp-interval 5 level-1
```

# isis hello-interval

To specify the length of time between Hello packets that the router sends, use the **isis hello-interval** interface configuration command. To restore the default value, use the **no** form of this command.

**isis hello-interval** *seconds* {**level-1** | **level-2**}
**no isis hello-interval** {**level-1** | **level-2**}

## Syntax Description

| | |
|---|---|
| *seconds* | Unsigned integer value. A value three times the Hello interval *seconds* is advertised as the *holdtime* in the Hello packets transmitted. It must be the same for all routers attached to a common network. With smaller Hello intervals, topological changes are detected faster, but there is more routing traffic. The default is 10 seconds. |
| **level-1** | Configures the Hello interval for Level 1 independently. Use this on X.25, SMDS, and Frame Relay multiaccess networks. |
| **level-2** | Configures the Hello interval for Level 2 independently. Use this on X.25, SMDS, and Frame Relay multiaccess networks. |

## Default

10 seconds

## Command Mode

Interface configuration

## Usage Guidelines

The Hello interval can be configured independently for Level 1 and Level 2, except on serial point-to-point interfaces. (Because there is only a single type of Hello packet sent on serial links, it is independent of Level 1 or Level 2.) The **level-1** and **level-2** keywords are used on X.25, SMDS, and Frame Relay multiaccess networks.

## Example

In the following example, interface serial 0 is configured to advertise Hello packets every 5 seconds. The router is configured to act as a station router. This will cause more traffic than configuring a longer interval, but topological changes will be detected faster.

```
interface serial 0
isis hello-interval 5 level-1
```

# isis metric

To configure the metric for an interface, use the **isis metric** interface configuration command. To restore the default metric value, use the **no** form of this command.

**isis metric** *default-metric* [*delay-metric* [*expense-metric* [*error-metric*]]] {**level-1** | **level-2**}
**no isis metric** {**level-1** | **level-2**}

## Syntax Description

| | |
|---|---|
| *default-metric* | Metric used for the redistributed route. The default metric is used as a value for the IS-IS metric. This is the value assigned when there is no QOS routing performed. Only this metric is supported by Cisco routers. You can configure this metric for Level 1 and/or Level 2 routing. The range is from 0 to 63. The default value is 10. |
| *delay-metric* | Not supported. |
| *expense-metric* | Not supported. |
| *error-metric* | Not supported. |
| **level-1** | Router acts as a station router (Level 1) only. |
| **level-2** | Router acts as an area router (Level 2) only. |

## Default

*default-metric* = 10

## Command Mode

Interface configuration

## Usage Guidelines

Specifying the **level-1** or **level-2** keywords resets the metric only for Level 1 or Level 2 routing, respectively.

## Example

In the following example, interface serial 0 is configured for a default link-state metric cost of 15 for Level 1:

```
interface serial 0
isis metric 15 level-1
```

## Related Commands

**default-information**
**redistribute**

# isis password

To configure the authentication password for an interface, use the **isis password** interface configuration command. To disable authentication for IS-IS, use the **no** form of this command.

**isis password** *password* {**level-1** | **level-2**}
**no isis password** {**level-1** | **level-2**}

## Syntax Description

| | |
|---|---|
| *password* | Authentication password you assign for an interface. |
| **level-1** | Configures the authentication password for Level 1 independently. For Level 1 routing, the router acts as a station router only. |
| **level-2** | Configures the authentication password for Level 2 independently. For Level 2 routing, the router acts as an area router only. |

## Default

Disabled

## Command Mode

Interface configuration

## Usage Guidelines

Different passwords can be assigned for different routing levels using the **level-1** and **level-2** keyword arguments.

Specifying the **level-1** or **level-2** keywords disables the password only for Level 1 or Level 2 routing, respectively. If no keyword is specified, the default is **level-1**.

## Example

The following example configures a password for interface serial 0 at Level 1:

```
interface serial 0
isis password frank level-1
```

# isis priority

To configure the priority of designated routers, use the **isis priority** interface configuration command. To reset the default priority, use the **no** form of this command.

**isis priority** *value* {**level-1** | **level-2**}
**no isis priority** {**level-1** | **level-2**}

## Syntax Description

| | |
|---|---|
| *value* | Sets the priority of a router and is a number from 0 to 127. The default value is 64. |
| **level-1** | Sets the priority of a router for Level 1 independently. |
| **level-2** | Sets the priority of a router for Level 2 independently. |

## Default

Priority of 64

## Command Mode

Interface configuration

## Usage Guidelines

Priorities can be configured for Level 1 and Level 2 independently. Specifying the **level-1** or **level-2** keywords resets priority only for Level 1 or Level 2 routing, respectively.

## Example

The following example shows Level 1 routing given priority by setting the priority level to 50:

```
interface serial 0
isis priority 50 level-1
```

# isis retransmit-interval

To configure the time between retransmission of IS-IS link-state PDU (LSP) retransmission for point-to-point links, use the **isis retransmit-interval** interface configuration command. To restore the default value, use the **no** form of this command.

**isis retransmit-interval** *seconds*
**no isis retransmit-interval** *seconds*

## Syntax Description

| | |
|---|---|
| *seconds* | Time in seconds between retransmission of IS-IS LSP retransmissions. It is an integer that should be greater than the expected round-trip delay between any two routers on the attached network. The default is 5 seconds. |

## Default

5 seconds

## Command Mode

Interface configuration

## Usage Guidelines

The setting of the *seconds* argument should be conservative, or needless retransmission will result. The value should be larger for serial lines and virtual links.

## Example

The following example configures interface serial 0 for retransmission of IS-IS LSP every 10 seconds for a large serial line:

```
interface serial 0
isis retransmit-interval 10
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**encapsulation ppp** †
**frame-relay keepalive** †
**smds dxi** †

# match as-path

To match a BGP autonomous system path access list, use the **match as-path** route-map configuration command. To remove a path list entry, 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 through 199. |

## Default

No path lists are defined.

## Command Mode

Route-map configuration

## Usage Guidelines

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

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 o modify only some data, you must configure second route-map section with an explicit match specified.

The implemented weight is based on the first matched autonomous system path.

## Example

In the following example, the AS path is set to match BGP autonomous system path access list 20:

```
route-map igp2bgp
match as-path 20
```

## Related Commands

**route-map**
**set**

# match interface

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

**match interface** *type number...type number*
**no match interface** *type number...type number*

## Syntax Description

| | |
|---|---|
| *type* | Interface type |
| *number* | Interface number |

## Default

No match interfaces are defined.

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. 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 o modify only some data, you must configure second route-map section with an explicit match specified.

## Example

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

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

## Related Commands

**route-map**
**set**

# match ip address

To distribute any routes that have a destination network number address that is permitted by a standard access list, use the **match ip address** route-map configuration command. To remove the **match ip address** entry, se the **no** form of this command.

**match ip address** *access-list-number...access-list-number*
**no match ip address** *access-list-number...access-list-number*

## Syntax Description

| | |
|---|---|
| *access-list-number* | Number of an access list. It can be an integer from 1 through 99. |

## Default

No access list numbers are specified.

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. 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 o modify only some data, you must configure second route-map section with an explicit match specified.

## Example

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

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

## Related Commands

**route-map**
**set**

# 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** route-map configuration command. To remove the next-hop entry, use the **no** form of this command.

**match ip next-hop** *access-list-number...access-list-number*
**no match ip next-hop** *access-list-number...access-list-number*

## Syntax Description

| | |
|---|---|
| *access-list-number* | Number of an access list. It can be an integer from 1 through 99. |

## Default

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

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. 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 o modify only some data, you must configure second route-map section with an explicit match specified.

## Example

In the following example, 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

**route-map**
**set**

# match ip route-source

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

**match ip route-source** *access-list-number...access-list-number*
**no match ip route-source** *access-list-number...access-list-number*

## Syntax Description

| | |
|---|---|
| *access-list-number* | Number of an access list. It can be an integer from 1 through 99. |

## Default

No filtering on route source.

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. 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 o modify only some data, you must configure second route-map section with an explicit match specified.

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

## Example

In the following example, routes that have been advertised by routers at the addresses specified by access lists 5 and 80 will be distributed:

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

## Related Commands

**route-map**
**set**

# match metric

To redistribute routes with the metric specified, use the **match metric** route-map configuration command. 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 IGRP five-part metric. It is a metric value from 0 through 4294967295. |

## Default

No filtering on a metric value.

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. 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 o modify only some data, you must configure second route-map section with an explicit match specified.

## Example

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

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

## Related Commands

**route-map**
**set**

# match route-type

To redistribute routes of the specified type, use the **match route-type** route-map configuration command. 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 BGP routes |
| **internal** | OSPF intra-area and interarea routes or enhanced IGRP internal routes |
| **external** [**type-1** \| **type-2**] | OSPF external routes, or enhanced IGRP external routes. For OSPF, **external type-1** matches only type 1 external routes and **external type-2** matches only type 2 external routes. |
| **level-1** | IS-IS Level 1 routes |
| **level-2** | IS-IS Level 2 routes |

## Default

Disabled

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. 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 second route-map section with an explicit match specified.

## Example

In the following example, internal routes will be redistributed:

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

## Related Commands

**route-map**
**set**

# match tag

To redistribute routes in the routing table that match the specified tags, use the **match tag** command. 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 through 4294967295. |

## Default

No match tag values are defined.

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. 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 o modify only some data, you must configure second route-map section with an explicit match specified.

## Example

In the following example, routes stored in the routing table with tag 5 will be redistributed:

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

## Related Commands

**route-map**
**set**

# mbranch

To trace a branch of a multicast tree for a specific group, use the **mbranch** EXEC command.

**mbranch** {*group-address* | *group-name*} *branch-address* [*ttl*]

## Syntax Description

| | |
|---|---|
| *group-address* | Address of the multicast group. This is a multicast IP address in four-part dotted notation. |
| *group-name* | Name of the multicast group, as defined in the DNS hosts table or with the **ip host** command. |
| *branch-address* | Address of a router that is on the tree branch. This is a unicast IP address in four-part dotted notation. |
| *ttl* | (Optional) Time-to-live value, in hops, that is used in trace request packets sent to the branch router. The default value is 30. |

## Command Mode

EXEC

## Usage Guidelines

The **mbranch** command sends multicast IGMP trace request packets to the specified branch router. It displays information about the branch starting with the local (requesting) router and ending with the branch router. This is considered to be the forward direction.

The information returned shows how a multicast packet sourced by this router will be forwarded by each router on the path to the router with the branch address.

The router with the address *branch-address* is the only router that responds to the trace request packets. The response is unicast to the source.

It is important to specify a value for the *ttl* argument if you are tracing through a router on which a multicast threshold has been set with the **ip multicast-threshold** interface configuration command.

## Sample Display

The following is sample output from the **mbranch** command. This trace is between the same routers as shown in the example for the **mrbranch** command. Note the order of responses. Also note that the outgoing interface list is the same.

```
PIM2# mbranch 224.0.255.2 198.92.118.2
Type escape sequence to abort.
Tracing route to group CBONE-WB (224.0.255.2) to 198.92.118.2

Response from 10.17.118.10, 76 msec
  1 PIM9 (10.1.22.9) <- PIM2 (10.1.37.2)
      Interface list: 131.108.62.0/24 131.108.22.0/24 10.7.0.0/16
  2 PIM-CR (131.108.62.18) <- PIM9 (131.108.62.52)
      Interface list: 131.108.20.0/24 131.108.53.0/24 131.108.50.0/24
                      10.16.0.0/16 10.17.0.0/16
  3 10.17.118.10 <- 10.17.20.31
      Interface list: 198.92.118.0/26 198.92.118.192/26
```

Table 17-3 describes the fields shown in the display.

**Table 17-3 Mbranch Field Descriptions**

| Field | Description |
|---|---|
| Response from 10.17.118.10 | Address of the router from which the response to the trace request packets came. This is a different interface on the router to which you sent the packet. |
| 76 msec | How long it took to receive the response. |
| 1 | Order number of routers in the trace path. In this example, the request went through 3 routers to reach the router that responded to the request. |
| PIM9 (10.1.22.9) <- PIM2 (10.1.37.2) | Route of the trace request. In this example, the request went from the router PIM2 to the router PIM9 (PIM2 is considered to be PIM9's RPF neighbor), then from PIM9 to PIM-CR, and finally to the router at 10.17.118.10. |
| Interface list: 131.108.62.0/24 131.108.22.0/24 10.7.0.0/16 | Interfaces out which a multicast packet forwarded by the router listed on the right side of the previous line (here, PIM2) will be forwarded. In this example, you interpret this line as follows: When the trace packet reached PIM9, it was replicated three times and one copy was sent out each of the three interfaces listed (131.108.62.0, 131.108.22.0, and 10.7.0.0). The interface list shows the subnet number and the mask rather than the interface name. This allows you to more easily figure out the packet's path because you can connect all like-numbered subnets together as a tree in order to detect loops. The source of the multicast packet is always the address of the router that started the **mbranch** (in this case, 10.1.37.2). The list does not include interfaces that failed access list conditions or TTL threshold criteria. |

## Related Commands

**ip multicast-threshold**
**mbranch**

# metric holddown

To keep new IGRP routing information from being used for a certain period of time, use the **metric holddown** router configuration command. 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.

### Default

Disabled

### Command Mode

Router configuration

### Usage Guidelines

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

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

### Example

The following example disables metric holddown:

```
router igrp 15
network 131.108.0.0
network 192.31.7.0
no metric holddown
```

### Related Commands

**metric maximum-hops**
**metric weights**
**timers basic**

# metric maximum-hops

To have the IP routing software to advertise as unreachable those routes with a hop count higher than is specified by the command (IGRP only), use the **metric maximum-hops** router configuration command. To reset the value to the default, use the **no** form of this command.

**metric maximum-hops** *hops*
**no metric maximum-hops** *hops*

## Syntax Description

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

## Default

100 hops

## Command Mode

Router configuration

## 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* argument.

## Example

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 decided to do this because they have a complex WAN that can generate a large hop count under normal (nonlooping) operations.

```
router igrp 71
network 15.0.0.0
metric maximum-hops 200
```

## Related Commands

**metric holddown**
**metric weights**

# metric weights

To allow the tuning of the IGRP or Enhanced IGRP metric calculations, use the **metric weights** router configuration command. 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. Currently, it must always be zero. |
| *k1–k5* | Constants that convert an IGRP or enhanced IGRP metric vector into a scalar quantity. |

## Default

*tos*: 0
*k1*: 1
*k2*: 0
*k3*: 1
*k4*: 0
*k5*: 0

## Command Mode

Router configuration

## Usage Guidelines

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

If k5 equals 0, the composite IGRP or enhanced IGRP 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 done:

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

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

Delay is in units of 10 microseconds. This gives a range of 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. This gives a range of 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 17-4 lists the default values used for several common media.

**Table 17-4 Bandwidth Values by Media Type**

| Media Type | Delay | Bandwidth |
|---|---|---|
| Satellite | 5120 (2 seconds) | 5120 (500 Mbits) |
| Ethernet | 25600 (1 ms) | 256000 (10 Mbits) |
| 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.

## Example

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

```
router igrp 109
network 131.108.0.0
metric weights 0 2 0 2 0 0
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**bandwidth** †
**delay** †
**metric holddown**
**metric maximum-hops**

# mrbranch

To trace a branch of a multicast tree for a group in the reverse direction, use the **mrbranch** EXEC command.

**mrbranch** {*group-address* | *group-name*} *branch-address* [*ttl*]

## Syntax Description

| | |
|---|---|
| *group-address* | Address of the multicast group. This is a multicast IP address in four-part dotted notation. |
| *group-name* | Name of the multicast group, as defined in the DNS hosts table or with the **ip host** command. |
| *branch-address* | Address of a router on the tree branch. This is a unicast IP address in four-part dotted notation. |
| *ttl* | (Optional) Time-to-live value, in hops, that is used in trace request packets sent to the branch router. The default value is 30. |

## Command Mode

EXEC

## Usage Guidelines

The **mrbranch** command sends trace request packets to the specified branch router. Queries are sent recursively to all the routers in the branch. This command displays information about the branch starting with the router farthest away and working towards the requesting router. This is considered to be the reverse direction.

The information returned shows how a multicast packet sourced by this router will be forwarded by each router along the branch.

The router with the address *branch-address* responds to the trace request packets. The requesting router then sends a query to the router that is the first router's RPF neighbor. Both the request and response packets have unicast addresses.

The number of packets generated by this command is two times the number of routers between the source router and the specified branch router.

## Sample Output

The following is sample output from the **mrbranch** command. This example is between the same router as shown in the **mbranch** command. Note the order of the responses. Also note that the outgoing interface list is the same.

```
PIM2# mrbranch 224.0.255.2 10.17.118.10
Type escape sequence to abort.
Tracing route to group CBONE-WB (224.0.255.2) from 10.17.118.10

Response from 10.17.118.10, 68 msec
  1 10.17.118.10 <- 10.17.20.31
      Interface list: 198.92.118.0/26 198.92.118.192/26
Response from PIM-CR (131.108.62.18), 12 msec
  1 PIM-CR (131.108.62.18) <- PIM9 (131.108.62.52)
      Interface list: 131.108.20.0/24 131.108.53.0/24 131.108.50.0/24
                      10.16.0.0/16 10.17.0.0/16
Response from PIM9 (131.108.62.52), 8 msec
  1 PIM9 (131.108.62.52) <- PIM2 (10.1.37.2)
      Interface list: 131.108.22.0/24 131.108.62.0/24 10.7.0.0/16
```

Table 17-5 describes the fields shown in the display.

**Table 17-5 Mrbranch Field Descriptions**

| Field | Description |
|---|---|
| Tracing route to group CBONE-WB (224.0.255.2) from 10.17.118.10 | Route that is being traced. |
| 68 msec | How long it took to receive the response. |
| Response from 10.17.118.10 | Address of the router from which the response to the trace request packets came. |
| 1 | Order number of routers in the trace path. |
| 10.17.118.10 <- 10.17.20.31 | RPF (reverse path forwarding) neighbor information. The first response in this example indicates that a multicast packet sent from the router PIM2 will be received on interface 10.17.118.10. This multicast packet should have been forwarded from 10.17.20.31 because that is the address that this router would use as the next-hop router (found in the IP routing table) to send a unicast packet back to the original source (PIM2) of the multicast packet. |
| Interface list: 198.92.118.0/26 198.92.118.192/26 | Interfaces out which a multicast packet from the router listed on the right side of the previous line (here, for the group 224.0.255.2 that had been forwarded by 10.17.20.31) will be forwarded. The list does not include interfaces that failed access list conditions or TTL threshold criteria. |

## Related Commands

**mbranch**
**show ip mroute**

# neighbor (EGP, IGRP, RIP)

To define a neighboring router with which to exchange routing information, use this form of the **neighbor** router configuration command. To remove an entry, use the **no** form of this command.

**neighbor** *ip-address*
**no neighbor** *ip-address*

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of a peer router with which routing information will be exchanged |

## Default

No neighboring routers are defined.

## Command Mode

Router configuration

## Usage Guidelines

For exterior routing protocol EGP, this command specifies routing peers. For normally broadcast protocols such as IGRP or RIP, this command permits the point-to-point (nonbroadcast) exchange of routing information. When used in combination with the **passive-interface** router configuration command, routing information can be exchanged between a subset of routers on a LAN.

Multiple **neighbor** commands can be used to specify additional neighbors or peers.

OSPF has its own version of the **neighbor** command. See the **neighbor** (OSPF) command page in this chapter.

## Examples

The following example establishes an EGP neighbor:

```
autonomous-system 109
router egp 110
neighbor 131.108.1.1
```

In the following example, IGRP updates are sent to all interfaces on network 131.108.0.0 except interface Ethernet 1. However, in this case a **neighbor** router configuration command is included. This command permits the sending of routing updates to specific neighbors. One copy of the routing update is generated per neighbor.

```
router igrp 109
network 131.108.0.0
passive-interface ethernet 1
neighbor 131.108.20.4
```

## Related Command

**passive-interface**

# neighbor (OSPF)

To configure OSPF routers interconnecting to nonbroadcast networks, use this form of the **neighbor** router configuration command. To remove a configuration, use the **no** form of this command.

**neighbor** *ip-address* [**priority** *number*] [**poll-interval** *seconds*]
**no neighbor** *ip-address* [**priority** *number*] [**poll-interval** *seconds*]

## Syntax Description

| | |
|---|---|
| *ip-address* | Interface IP address of the neighbor. |
| **priority** *number* | (Optional) 8-bit number indicating the router priority value of the nonbroadcast neighbor associated with the IP address specified. The default is 0. |
| **poll-interval** *seconds* | (Optional) Unsigned integer value reflecting the poll interval. RFC 1247 recommends that this value should be much larger than the Hello interval. The default is 2 minutes (120 seconds). |

## Default

No configuration is specified.

## Command Mode

Router configuration

## Usage Guidelines

X.25 and Frame Relay provide an optional broadcast capability that can be configured in the map to allow OSPF to run as a broadcast network. At the OSPF level you can configure the router as a broadcast network. See the **x25 map** and **frame-relay map** interface configuration command descriptions in "X.25 Commands" and "Frame Relay Commands" chapters, respectively, of this manual for more detail.

One neighbor entry must be included in the router's configuration for each known nonbroadcast network neighbor. The neighbor address has to be on the primary address of the interface.

If a neighboring router has become inactive (Hello packets have not been seen for the Router DeadInterval period), it may still be necessary to send Hello packets to the dead neighbor. These Hello packets will be sent at a reduced rate called *Poll Interval*.

When the router first starts up, it sends only Hello packets to those routers with non-zero priority, that is, routers which are eligible to become designated routers (DR) and backup designated routers (BDR). After DR and BDR are selected, DR and BDR will then start sending Hello packets to all neighbors in order to form adjacencies.

## Example

The following example declares a router at address 131.108.3.4 on a nonbroadcast network, with a priority of 1 and a poll-interval of 180:

```
router ospf
neighbor 131.108.3.4 priority 1 poll-interval 180
```

### Related Command

**ip ospf priority**

# neighbor advertisement-interval

To set the minimum interval between the sending of BGP routing updates, use the **neighbor advertisement-interval** router configuration command. To remove an entry, use the **no** form of this command.

**neighbor** {*address* | *tag*} **advertisement-interval** *seconds*
**no neighbor** {*address* | *tag*} **advertisement-interval** *seconds*

## Syntax Description

| | |
|---|---|
| *address* | Neighbor address. |
| *tag* | Neighbor tag. |
| *seconds* | Time in seconds. Integer from 0 through 600. |

## Default

30 seconds for external peers and 5 seconds for internal peers.

## Command Mode

Router configuration

## Example

In the following example, the minimum time between sending BGP routing updates is set to 10 seconds:

```
router bgp 5
neighbor 4.4.4.4 advertisement-interval 10
```

# neighbor any

To control how neighbor entries are added to the routing table for both EGP and BGP, use the **neighbor any** router configuration command . To remove a configuration, use the **no** form of this command.

**neighbor any** [*access-list-number*]
**no neighbor any** [*access-list-number*]

## Syntax Description

| | |
|---|---|
| *access-list-number* | (Optional) Access list number the neighbor must be accepted by to be allowed to peer with the EGP or BGP process. If no list is specified, any neighbor will be allowed to peer with the router. |

## Default

No configuration is specified.

## Command Mode

Router configuration

## Example

The following example configuration illustrates the use of the **neighbor any** command in conjunction with the **access-list** global configuration command:

```
access-list 1 permit 10.0.0.0 0.255.255.255
! global access list assignment
router egp 0
neighbor any 1
```

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**access-list** †
**neighbor any third-party**
**router egp 0**

# neighbor any third-party

To configure an EGP process that determines which neighborsare treated as the next hop in EGP advertisements, use the **neighbor any third-party** router configuration command. To remove a configuration, use the **no** form of this command.

**neighbor any third-party** *ip-address* [**internal** | **external**]
**no neighbor any third-party** *ip-address* [**internal** | **external**]

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of the third-party router that is to be the next hop in EGP advertisements. |
| **internal** | (Optional) Indicates that the third-party router should be listed in the internal section of the EGP update. |
| **external** | (Optional) Indicates that the third-party router should be listed in the external section of the EGP update. |

## Default

No EGP process is configured.

## Command Mode

Router configuration

## Example

The following example illustrates how to specify the particular neighbors that an EGP process will view as peers:

```
access-list 2 permit 10.0.0.0 0.255.255.255
! global access list assignment
router egp 0
neighbor any 2
neighbor any third-party 10.1.1.1
```

## Related Commands

**neighbor any**
**router egp 0**

# neighbor configure-neighbors

To have the router treat temporary neighbors that have been accepted by a template as if they had been configured manually, use the **neighbor configure-neighbors** router configuration command . To restore the default, use the **no** form of this command.

**neighbor** *template-name* **configure-neighbors**
**no neighbor** *template-name* **configure-neighbors**

## Syntax Description

| | |
|---|---|
| *template-name* | User-selectable designation that identifies a particular template. This can be an arbitrary word. |

## Default

New neighbors are treated as temporary.

## Command Mode

Router configuration

## Usage Guidelines

Under normal circumstances, neighbors that are allowed to connect to the router because you had configured a template are treated as temporary. When a temporary neighbor disconnects, the local router will not try to actively reestablish a connection with it. In addition, information about temporary neighbors will not show up in the router configuration (**write terminal**).

When **configure-neighbors** is enabled on a particular template, any neighbor accepted by that template will be treated as if it had been manually configured. These neighbors will show up in **write terminal** displays and will be written to the nonvolatile configuration if a **write memory** command is issued.

## Example

In the following example, any BGP speaker matching access-list 7 can connect to the router and exchange information. Any neighbor that connects will be treated as if it had been manually configured.

```
access-list 7 permit 168.89.3.0 0.0.0.255
neighbor internal-ethernet neighbor-list 7
neighbor internal-ethernet configure-neighbors
```

## Related Command

**neighbor neighbor-list**

# neighbor distribute-list

To distribute BGP neighbor information as specified in an access list, use the **neighbor distribute-list** router configuration command. To remove an entry, use the **no** form of this command.

**neighbor** *ip-address* **distribute-list** *access-list-number* {**in** | **out**}
**no neighbor** *ip-address* **distribute-list** *access-list-number* {**in** | **out**}

## Syntax Description

| | |
|---|---|
| *ip-address* | Neighbor's IP address. |
| *access-list-number* | Predefined access list number. Only standard access lists can be used with this command. |
| **in** | Access list is applied to incoming advertisements to that neighbor. |
| **out** | Access list is applied to outgoing advertisements from that neighbor. |

## Default

No BGP neighbor is specified.

## Command Mode

Router configuration

## Usage Guidelines

Using distribute lists is one of two ways to filter BGP advertisements. The other way is to use AS-path filters, as with the **ip as-path access-list** global configuration command and the **neighbor filter-list** command.

## Example

The following example applies list 39 to incoming advertisements to neighbor 120.23.4.1:

```
router bgp 109
network 131.108.0.0
neighbor 120.23.4.1 distribute-list 39 in
```

## Related Commands

**ip as-path access-list**
**neighbor filter-list**

# neighbor ebgp-multihop

To accept and attempt BGP connections to external peers residing on networks that are not directly connected, use the **neighbor ebgp-multihop** router configuration command. To return to the default, use the **no** form of this command.

**neighbor** *ip-address* **ebgp-multihop**
**no neighbor** *ip-address*

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of the BGP-speaking neighbor. |

## Default

Only directly connected neighbors are allowed.

## Command Mode

Router configuration

## Usage Guidelines

This feature should only be used under the guidance of technical support staff.

## Example

The following example allows connections to or from neighbor 131.108.1.1, which resides on a network that is not directly connected.

```
router bgp 109
neighbor 131.108.1.1 ebgp-multihop
```

# neighbor filter-list

To set up BGP filter, use the **neighbor filter-list** router configuration command. To disable this function, use the **no** form of this command.

**neighbor** *ip-address* **filter-list** *access-list-number* {**in** | **out** | **weight** *weight*}
**no neighbor** *ip-address* **filter-list** *access-list-number* {**in** | **out** | **weight** *weight*}

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of the neighbor. |
| *access-list-number* | Number of an access for the autonomous system path. You define this access list with the **ip as-path access-list** command. |
| **in** | Access list to incoming routes. |
| **out** | Access list to outgoing routes. |
| **weight** *weight* | Assigns a relative importance to incoming routes matching autonomous system paths. Acceptable values are 0 to 65535. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

This command establishes filters on both inbound and outbound BGP routes. Any number of weight filters are allowed on a per-neighbor basis, but only one in or out filter is allowed. The weight of a route affects BGP's route-selection rules.

The implemented weight is based on the first matched autonomous system path. Weights indicated when an autonomous system path is matched override the weights assigned by global **neighbor** commands. In other words, the weights assigned with the **match as-path** and **set weight** route-map commands override the weights assigned using the **neighbor weight** and **neighbor filter-list** commands.

See the "Regular Expressions" appendix for information on forming regular expressions.

## Example

In the following example, the BGP neighbor with IP address 128.125.1.1 is not sent advertisements about any path through or from the adjacent autonomous system 123:

```
ip as-path access-list 1 deny _123_
ip as-path access-list 1 deny ^123 .*
! The space in the above expression (^123 .*)is required.

router bgp 109
network 131.108.0.0
neighbor 129.140.6.6 remote-as 123
neighbor 128.125.1.1 remote-as 47
neighbor 128.125.1.1 filter-list 1 out
```

## Related Commands

**ip as-path access-list**
**neighbor distribute-list**
**neighbor weight**

# neighbor neighbor-list

To configure BGP to support anonymous neighbor peers by configuring a neighbor template, use the **neighbor neighbor-list** router configuration command. To delete a template, use the **no** form of this command.

**neighbor** *template-name* **neighbor-list** *access-list-number*
**no neighbor** *template-name* **neighbor-list**

## Syntax Description

| | |
|---|---|
| *template-name* | User-selectable designation that identifies a particular template (an arbitrary word). |
| *access-list-number* | Number of an access list. It can be a number in the range 1 through 99. |

## Default

No configuration is defined.

## Command Mode

Router configuration

## Usage Guidelines

To specify a group of anonymous neighbors, configure a neighbor template rather than specifically configure each neighbor. The template allows you to specify an IP access list which defines remote systems that can establish a BGP connection to the router. External BGP peers must be on a directly connected Ethernet unless they are overridden by the **neighbor ebgp-multihop** command.

Once you specify a template, you configure the template as if it were a regular neighbor entry, such as setting the protocol version or filter lists, so that anonymous neighbors accepted by the template will receive the settings of the template.

These neighbors accepted by the template appear in the **show ip bgp summary** and **show ip bgp neighbor** displays, although they do not appear in the router configuration. When the session is disconnected, all knowledge about the neighbor is discarded and the router will not attempt to actively re-establish a connection.

You can use the **neighbor configure-neighbors** command to request that the router treat peers learned through a template as if they were manually configured neighbors. These peers will then show up in **write terminal** displays and can be stored as part of the nonvolatile configuration.

The **no neighbor neighbor-list** command deletes the template and cause any temporary neighbors accepted by the template to be shut down and removed.

## Examples

In the following example, any BGP speaker from 168.89.3.0 can connect to the router and exchange information:

```
access-list 7 permit 168.89.3.0 0.0.0.255
neighbor internal-ethernet neighbor-list 7
neighbor internal-ethernet configure-neighbors
```

In the following example, any BGP speaker in the connected internet can establish a BGP connection to the local router, and the local router will send them routing information. However, the distribute-list clause instructs the local router to ignore all information these remote BGP speakers send to it.

```
access-list 9 permit 0.0.0.0 255.255.255.255
access-list 10 deny 0.0.0.0 255.255.255.255
neighbor route-server-peers neighbor-list 9
neighbor route-server-peers distribute-list 10 in
```

## Related Commands

**access-list (standard)**
**neighbor configure-neighbors**
**neighbor ebgp-multihop**

# neighbor next-hop-self

To disable next-hop processing of BGP updates on the router, use the **neighbor next-hop-self** router configuration command. To disable this feature, use the **no** form of this command.

**neighbor** *ip-address* **next-hop-self**
**no neighbor** *ip-address* **next-hop-self**

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of the BGP-speaking neighbor |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

This command is useful in nonmeshed networks such as Frame Relay or X.25 where BGP neighbors may not have direct access to all other neighbors on the same IP subnet.

## Example

The following example forces all updates destined for 131.108.1.1 to advertise this router as the next hop:

```
router bgp 109
neighbor 131.108.1.1 next-hop-self
```

# neighbor remote-as

To add an entry to the BGP neighbor table, use the **neighbor remote-as** router configuration command. To remove an entry from the table, use the **no** form of this command .

**neighbor** *ip-address* **remote-as** *number*
**no neighbor** *ip-address* **remote-as** *number*

## Syntax Description

| | |
|---|---|
| *ip-address* | Neighbor's IP address |
| *number* | Autonomous system to which the neighbor belongs |

## Default

There are no BGP neighbor peers.

## Command Mode

Router configuration

## Usage Guidelines

Specifying a neighbor with an autonomous system number that matches the autonomous system number specified in the **router bgp** global configuration command identifies the neighbor as internal to the local autonomous system. Otherwise, the neighbor is considered external.

## Examples

The following example specifies that the router at the address 131.108.1.2 is a neighbor in autonomous system number 109:

```
router bgp 110
network 131.108.0.0
neighbor 131.108.1.2 remote-as 109
```

In the following example, a BGP router is assigned to autonomous system 109, and two networks are listed as originating in the autonomous system. Then the addresses of three remote routers (and their autonomous systems) are listed. The router being configured will share information about networks 131.108.0.0 and 192.31.7.0 with the neighbor routers. The first router listed is in the same Class B network address space, but in a different autonomous system; the second **neighbor** command illustrates specification of an internal neighbor (with the same autonomous system number) at address 131.108.234.2; and the last **neighbor** command specifies a neighbor on a different network.

```
router bgp 109
network 131.108.0.0
network 192.31.7.0
neighbor 131.108.200.1  remote-as 167
neighbor 131.108.234.2  remote-as 109
neighbor 150.136.64.19  remote-as  99
```

# neighbor route-map

To apply a route map to incoming or outgoing routes, use the **neighbor route-map** router configuration command. To remove a route map, use the **no** form of this command.

**neighbor** {*address* | *tag*} **route-map** *route-map-name* {**in** | **out**}
**no neighbor** {*address* | *tag*} **route-map** *route-map-name* {**in** | **out**}

## Syntax Description

| | |
|---|---|
| *address* | Neighbor's IP address |
| *tag* | Neighbor tag |
| *route-map-name* | Name of route map |
| **in** | Apply to incoming routes |
| **out** | Apply to outgoing routes |

## Default

No route maps are applied to a peer.

## Command Mode

Router configuration

## Usage Guidelines

If an outbound route map is specified, it is proper behavior to only advertise routes that match at least one section of the route map.

## Examples

In the following example, route map "internal-map" is applied to incoming route from 198.92.70.24:

```
router bgp 5
neighbor 198.92.70.24 route-map internal-map in
!
route-map internal-map
match as-path 1
set local-preference 100
```

# neighbor third-party

To send updates regarding EGP third-party routers, use the **neighbor third-party** router configuration command. To disable these updates, use the **no** form of this command.

**neighbor** *ip-address* **third-party** *third-party-ip-address* [**internal** | **external**]
**no neighbor** *ip-address* **third-party** *third-party-ip-address* [**internal** | **external**]

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of the EGP peer. |
| *third-party-ip-address* | Address of the third-party router on the network shared by the Cisco router and the EGP peer specified by *address*. |
| **internal** | (Optional) Indicates that the third-party router should be listed in the internal section of the EGP update. This is the default. |
| **external** | (Optional) Indicates that the third-party router should be listed in the external section of the EGP update. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

Using this *third-party mechanism*, EGP tells its peer that another router (the third party) on the shared network is the appropriate router for some set of destinations. If updates mentioning third-party routers are desired, use this command.

All networks reachable through the third-party router will be listed in the EGP updates as reachable by the router. The optional **internal** and **external** keywords indicate whether the third-party router should be listed in the internal or external section of the EGP update. Normally, all networks are mentioned in the internal section.

This command can be used multiple times to specify additional third-party routers.

## Examples

In the following example, routes learned from router 131.108.6.99 will be advertised to 131.108.6.5 as third-party internal routes:

```
neighbor 131.108.6.5  third-party 131.108.6.99 internal
```

In the following example, routes learned from 131.108.6.100 will be advertised to 131.108.6.5 as third-party external routes:

```
neighbor 131.108.6.5 third-party 131.108.6.100 external
```

# neighbor update-source

To have the router allow internal BGP sessions to use any operational interface for TCP connections, use the **neighbor update-source** router configuration command. To restore the interface assignment to the closest interface, which is called the best local address, use the **no** form of this command

**neighbor** *ip-address* **update-source** *interface*
**no neighbor** *ip-address* **update-source** *interface*

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of the BGP-speaking neighbor |
| *interface* | Loopback interface |

## Default

Best local address

## Command Mode

Router configuration

## Usage Guidelines

This feature works in conjunction with the Loopback interface feature described in the "Configuring Interfaces" chapter of the *Router Products Configuration Guide*.

## Example

In the following example, BGP TCP connections for the specified neighbor will be sourced with Loopback interface's IP address rather than the best-local-address:

```
router bgp 110
network 160.89.0.0
neighbor 160.89.2.3 remote-as 110
neighbor 160.89.2.3 update-source Loopback0
```

# neighbor version

To configure the router to accept only a particular version, use the **neighbor version** router configuration command. To use the default version level of a neighbor, use the **no** form of this command .

**neighbor** *ip-address* **version** *value*
**no neighbor** *ip-address* **version** *value*

## Syntax Description

| | |
|---|---|
| *ip-address* | IP address of the BGP-speaking neighbor. |
| **version** *value* | Version number. The version can be set to 2 to force the router to only use Version 2 with the specified neighbor. The default is to use Version 4 of BGP and dynamically negotiate down to Version 2 if requested. |

## Default

Version 4

## Command Mode

Router configuration

## Usage Guidelines

Entering this command disables dynamic version negotiation.

Our implementation of BGP supports Versions 2, 3, and 4 of BGP. If the neighbor does not accept default version 4, dynamic version negotiation is implemented to negotiate down to version 2.

## Example

The following example locks down to Version 4 of the BGP protocol:

```
router bgp 109
neighbor 131.104.27.2 version 4
```

# neighbor weight

To assign a weight to a neighbor connection, use the **neighbor weight** router configuration command. To remove a weight assignment, use the **no** form of this command.

**neighbor** *ip-address* **weight** *weight*
**no neighbor** *ip-address* **weight** *weight*

## Syntax Description

| | |
|---|---|
| *ip-address* | Neighbor's IP address. |
| **weight** *weight* | Weight to assign. Acceptable values are 0 to 65535. |

## Default

Routes learned through another BGP peer have a default weight of 0 and routes sourced by the local router have a default weight of 32768.

## Command Mode

Router configuration

## Usage Guidelines

All routes learned from this neighbor will have the assigned weight initially. The route with the highest weight will be chosen as the preferred route when multiple routes are available to a particular network.

The weights assigned with the **match as-path** and **set weight** route-map commands override the weights assigned using the **neighbor weight** and **neighbor filter-list** commands.

---

**Note** For weight changes to take effect, it may be necessary to use **clear ip bgp ***.

---

## Example

The following example sets the weight of all routes learned via 151.23.12.1 to 50:

```
router bgp 109
neighbor 151.23.12.1 weight 50
```

## Related Commands

**neighbor distribute-list**
**neighbor filter-list**

# net

To configure a Network Entity Title (NET) for the routing process, use the **net** router configuration command. To remove a NET, use the **no** form of this command.

**net** *network-entity-title*
**no net** *network-entity-title*

## Syntax Description

| | |
|---|---|
| *network-entity-title* | NET that specifies the area address and the system ID for an IS-IS routing process. This argument can be either an address or a name. |

## Default

No NET is configured.

## Command Mode

Router configuration

## Usage Guidelines

For IS-IS, multiple NETs per router are allowed, with a maximum of three. There is no default value for this command.

## Example

The following example specifies a single NET:

```
router isis Pieinthesky
net 47.0004.004d.0001.0000.0c11.1111.00
```

# network (BGP)

To specify the list of networks for the BGP routing process, use this form of the network router configuration command. To remove an entry, use the **no** form of this command.

**network** *network-number* **mask** *network-mask*
**no network** *network-number* **mask** *network-mask*

## Syntax Description

| | |
|---|---|
| *network-number* | IP address of a peer router with which routing information will be exchanged |
| *network-mask* | Network mask address |

## Default

No networks are specified.

## Command Mode

Router configuration

## Usage Guidelines

These types of networks can be learned from connected routes, dynamic routing, and from static route sources.

A maximum of 200 **network** commands may be specified for a single BGP process.

## Example

The following example sets up network 131.108.0.0 to be included in the router's BGP updates:

```
router bgp 120
network 131.108.0.0
```

## Related Commands

**router bgp**
**network backdoor**
**network mask**
**network weight**

# network (EGP)

To specify the list of networks for the EGP routing process, use this form of the **network** router configuration command. To remove an entry, use the **no** form of this command.

**network** *network-number*
**no network** *network-number*

## Syntax Description

| | |
|---|---|
| *network-number* | IP address of a peer router with which routing information will be exchanged |

## Default

No networks are specified.

## Command Mode

Router configuration

## Usage Guidelines

The networks to be advertised to the EGP peers of an EGP routing process are advertised with a distance of zero. The restrictions on the network you specify are that it must appear in the routing table, and the network number must not contain any subnet information. The network can be connected, statically configured, or redistributed into EGP from other routing protocols. Multiple commands can be used to specify additional networks.

## Example

The following example illustrates a typical configuration for an EGP router process. The router is in autonomous system 109 and is peering with routers in autonomous system 164. It will advertise the networks 131.108.0.0 and 192.31.7.0 to the router in autonomous system 164, 10.2.0.2. The information sent and received from peer routers can be filtered in various ways, including blocking information from certain routers and suppressing the advertisement of specific routes.

```
autonomous-system 109
router egp 164
network 131.108.0.0
network 192.31.7.0
neighbor 10.2.0.2
```

## Related Command

**router egp**

# network (IGRP and Enhanced IGRP)

To specify a list of networks for the Enhanced IGRP routing process, use this form of the **network** router configuration command. To remove an entry, use the **no** form of this command.

**network** *network-number*
**no network** *network-number*

## Syntax Description

| | |
|---|---|
| *network-number* | IP address of the directly connected networks |

## Default

No networks are specified.

## Command Mode

Router configuration

## Usage Guidelines

The network number specified must not contain any subnet information. You can specify multiple **network** commands.

IGRP or Enhanced IGRP sends updates to the interfaces in the specified network(s). Also, if an interface's network is not specified, it will not be advertised in any IGRP or Enhanced IGRP update.

## Example

The following example configures a router for IGRP and assigns autonomous system 109. The **network** commands indicate the networks directly connected to the router.

```
router igrp 109
network 131.108.0.0
network 192.31.7.0
```

## Related Command

**router igrp**
**router eigrp**

# network (RIP)

To specify a list of networks for the RIP routing process, use this form of the **network** router configuration command. To remove an entry, use the **no** form of this command.

**network** *network-number*
**no network** *network-number*

## Syntax Description

| | |
|---|---|
| *network-number* | IP address of the network of directly connected networks. |

## Default

No networks are specified.

## Command Mode

Router configuration

## Usage Guidelines

The network number specified must not contain any subnet information. You can specify multiple **network** commands. RIP routing updates will be sent and received only through interfaces on this network.

RIP sends updates to the interfaces in the specified network(s). Also, if an interface's network is not specified, it will not be advertised in any RIP update.

## Example

The following example defines RIP as the routing protocol to be used on all interfaces connected to networks 128.99.0.0 and 192.31.7.0:

```
router rip
network 128.99.0.0
network 192.31.7.0
```

## Related Command

**router rip**

# network area

To define the interfaces on which OSPF runs and to define the area ID for those interfaces, use the **network area** router configuration command. To disable OSPF routing for interfaces defined with the *address wildcard-mask* pair, use the **no** form of this command.

**network** *address wildcard-mask* **area** *area-id*
**no network** *address wildcard-mask* **area** *area-id*

## Syntax Description

| | |
|---|---|
| *address* | IP address. |
| *wildcard-mask* | IP-address-type mask that includes “don’t care” bits. |
| *area-id* | Area that is to be associated with the OSPF address range. It can be specified as either a decimal value or as an IP address. If you intend to associate areas with IP subnets, you can specify a subnet address as the *area-id*. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

The *address* and *wildcard-mask* arguments together allow you to define one or multiple interfaces to be associated with a specific OSPF area using a single command. Using the *wildcard-mask* allows you to define one or multiple interfaces to be associated with a specific OSPF area using a single command. If you intend to associate areas with IP subnets, you can specify a subnet address as the *area-id*.

The router sequentially evaluates the *address*/*wildcard-mask* pair for each interface as follows:

1. The *wildcard-mask* is logically ORed with the interface IP address.
2. The *wildcard-mask* is logically ORed with *address* in the **network** command.
3. The router compares the two resulting values.
4. If they match, OSPF is enabled on the associated interface and this interface is attached to the OSPF area specified.

**Note** Any individual interface can only be attached to a single area. If the address ranges specified for different areas overlap, the router will adopt the first area in the **network** command list and ignore the subsequent overlapping portions. In general, it is recommended that you devise address ranges that do not overlap in order to avoid inadvertent conflicts.

## Example

In the following partial example, OSPF routing process 109 is initialized, and four OSPF areas are defined: 10.9.50.0, 2, 3, and 0. Areas 10.9.50.0, 2, and 3 mask specific address ranges, while Area 0 enables OSPF for all other networks.

```
router ospf 109
network 131.108.20.0  0.0.0.255 area 10.9.50.0
network 131.108.0.0  0.0.255.255 area 2
network 131.109.10.0  0.0.0.255 area 3
network 0.0.0.0  255.255.255.255 area 0
```

## Related Command

**router ospf**

# network backdoor

To specify a backdoor route to a BGP border router that will provide better information about the network, use the **network backdoor** router configuration command. To remove an address from the lsite, use the **no** form of this command.

**network** *address* **backdoor**
**no network** *address* **backdoor**

## Syntax Description

| | |
|---|---|
| *address* | IP address of the network to which you want a backdoor route |

## Default

No network is advertised.

## Command Mode

Router configuration

## Usage Guidelines

A backdoor network is treated as a local network, except that it is not advertised.

## Example

The following example configures network 131.108.0.0 as a local network and network 192.31.7.0 as a backdoor network:

```
router bgp 109
network 131.108.0.0
network 192.31.7.0 backdoor
```

# network weight

To assign an absolute weight to a BGP network, use the **network weight** command. To delete an entry, use the **no** form of the command.

**network** *address* **weight** *weight*
**no network** *address* **weight** *weight*

## Syntax Description

| | |
|---|---|
| *address* | IP address of the network. |
| **weight** *weight* | Absolute weight, or importance. It can be an integer from 0 to 65535. |

## Default

Weight is unmodified. Weight is zero if the original default weight has not been modified by other router configuration commands.

## Command Mode

Router configuration

## Usage Guidelines

The weight specified by this command overrides a weight assigned by the **redistribute** command.

## Example

In the following example,

```
router bgp 5
network 193.0.0.0 weight 100
```

# offset-list

To add an offset to incoming and outgoing metrics for networks matching a specified access list, use the **offset-list** router configuration command. To remove an offset list, use the **no** form of this command.

**offset-list** {**in** | **out**} *offset* [*access-list-number*]
**no offset-list** {**in** | **out**} *offset* [*access-list-number*]

## Syntax Description

| | |
|---|---|
| **in** | Applies the access list to incoming metrics. |
| **out** | Applies the access list to outgoing metrics. |
| *offset* | Positive offset to be applied to metrics for networks matching the access list. If the offset is zero, no action is taken. |
| *access-list-number* | (Optional) Access list to be applied. If unspecified, the argument supplied to *offset* is applied to all metrics. If *offset* is zero, no action is taken. For IGRP, the offset is added to the delay component only. Must be a standard access list. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

The offset value is added to the routing metric.

## Examples

The following example applies an offset of 10 to the router's delay component for all outgoing metrics:

```
offset-list out 10
```

In the following example, the router applies the same offset in the previous example only to access list 121:

```
offset-list out 10 121
```

# passive-interface

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

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

## Syntax Description

| | |
|---|---|
| *type* | Interface type |
| *number* | Interface number |

## Default

Routing updates are sent on the interface.

## Command Mode

Router configuration

## Usage Guidelines

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

For OSPF, OSPF routing information is neither sent nor received through the specified router interface. The specified interface address appears as a stub network in the OSPF domain.

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

Enhanced IGRP is disabled on an interface that is configured as passive although it advertises the route.

## Example

The following example sends IGRP updates to all interfaces on network 131.108.0.0 except interface Ethernet 1:

```
router igrp 109
network 131.108.0.0
passive-interface ethernet 1
```

The following configuration enables IS-IS on interfaces Ethernet 1 and serial 0 and advertises the IP addresses of Ethernet 0 in its Link State PDUs:

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

# redistribute

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

**redistribute** *protocol* [*process-id*] {**level-1** | **level-1-2** | **level-2**} [**metric** *metric-value*] [**metric-type** *type-value*] [**match** {**internal** | **external 1** | **external 2**}] [**tag** *tag-value*] [**route-map** *map-tag*] [**weight** *weight*] [**subnets**]
**no redistribute** *protocol* [*process-id*] {**level-1** | **level-1-2** | **level-2**} [**metric** *metric-value*] [**metric-type** *type-value*] [**match** {**internal** | **external 1** | **external 2**}] [**tag** *tag-value*] [**route-map** *map-tag*] [**weight** *weight*] [**subnets**]

## Syntax Description

| | |
|---|---|
| *protocol* | Source protocol from which routes are being redistributed. It can be one of the following keywords: **bgp**, **egp**, **igrp**, **isis**, **ospf**, **static** [**ip**], **connected**, and **rip**.<br>The keyword **static** [**ip**] is used to redistribute IP static routes. The optional **ip** keyword is used when redistributing into IS-IS.<br>The keyword **connected** refers to routes which are established automatically by virtue of having enabled IP on an interface. For routing protocols such as OSPF and IS-IS, these routes will be redistributed as external to the autonomous system. |
| *process-id* | (Optional) For **bgp**, **egp**, or **igrp**, this is an autonomous system number, which is a 16-bit decimal number.<br>For **isis**, this is an optional *tag* that defines a meaningful name for a routing process. You can specify only one IS-IS process per router. Creating a name for a routing process means that you use names when configuring routing.<br>For **ospf**, this is an appropriate OSPF process ID from which routes are to be redistributed. This identifies the routing process. This value takes the form of a nonzero decimal number.<br>For **rip**, no *process-id* value is needed. |
| **level-1** | For IS-IS, Level 1 routes are redistributed into other IP routing protocols independently. |
| **level-1-2** | For IS-IS, both Level 1 and Level 2 routes are redistributed into other IP routing protocols. |
| **level-2** | For IS-IS, Level 2 routes are redistributed into other IP routing protocols independently. |
| **metric** *metric-value* | (Optional) Metric used for the redistributed route. If a value is not specified for this option, and no value is specified using the **default-metric** router configuration command, the default metric value is 0. Use a value consistent with the destination protocol. |

| | |
|---|---|
| **metric-type** *type-value* | (Optional) For OSPF, the external link type associated with the default route advertised into the OSPF routing domain. It can be one of two values:<br>**1**—Type 1 external route<br>**2**—Type 2 external route<br>If a **metric-type** is not specified, the router adopts a Type 2 external route.<br>For IS-IS, it can be one of two values:<br>**internal**—IS-IS metric which is < 63.<br>**external**—IS-IS metric which is > 64 < 128.<br>The default is **internal**. |
| **match** {**internal** \| **external 1** \| **external 2**} | (Optional) For OPSF, the criteria by which OSPF routes are redistributed into other routing domains. It an be one of the following:<br>**internal**—Routes that are internal to a specific autonomous system.<br>**external 1**—Routes that are external to the autonomous system, but are imported into OSPF as type 1 external route.<br>**external 2**—Routes that are external to the autonomous system, but are imported into OSPF as type 2 external route. |
| **tag** *tag-value* | (Optional) 32-bit decimal value attached to each external route. This is not used by the OSPF protocol itself. It may be used to communicate information between Autonomous System Boundary Routers. If none is specified, then the remote autonomous system number is used for routes from BGP and EGP; for other protocols, zero (0) is used. |
| **route-map** | (Optional) Route map should be interrogated to filter the importation of routes from this source routing protocol to the current routing protocol. If not specified, all routes are redistributed. If this keyword is specified, but no route map tags are listed, no routes will be imported. |
| *map-tag* | (Optional) Identifier of a configured route map. |
| **weight** *weight* | (Optional) Network weight when redistributing into BGP. An integer between 0 and 65535. |
| **subnets** | (Optional) For redistributing routes into OSPF, the scope of redistribution for the specified protocol. |

## Default

Route redistribution is disabled.

## Command Mode

Router configuration

## Usage Guidelines

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

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

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

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

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

When routes are redistributed between OSPF processes, no OSPF metrics are preserved.

The only **connected** routes affected by this **redistribute** command are the routes not specified by the **network** command.

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

---

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

---

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

When routes are redistributed into OSPF and no metric is specified in the **metric** keyword, the default metric that OSPF uses is 20 for routes from all protocols except BGP route, which gets a metric of 1.

## Examples

The following are examples of the various configurations you would use to redistribute one routing protocol into another routing protocol.

The following example configuration causes OSPF routes to be redistributed into a BGP domain:

```
router bgp 109
redistribute ospf...
```

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

```
router ospf 110
redistribute igrp...
```

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

```
router ospf 109
redistribute igrp 108 metric 100 subnets
redistribute rip metric 200 subnets
```

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

```
router isis
redistribute bgp 120 metric 5 metric-type external
```

## Related Commands

**default-information originate**
**distribute-list out**
**route-map**
**show route-map**

# route-map

To define the conditions for redistributing routes from one routing protocol into another, use the **route-map** global configuration command and the route-map configuration commands **match** and **set**. To delete an entry, use the **no route-map** command.

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

## Syntax Description

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

## Default

No default is available.

## Command Mode

Global configuration

## Usage Guidelines

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**. 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.

Use route maps when you wish to have detailed control over how routes are redistributed between routing processes. The destination routing protocol is the one you specify with the **router** global configuration command. The source routing protocol is the one you specify with the **redistribute** router configuration command. See the following example as an illustration of how route maps are configured.

## Examples

The following example redistributes all OSPF routes into IGRP:

```
router igrp 109
redistribute ospf 110
default metric 1000 100 255 1 1500
```

The following example redistributes RIP routes with a hop count equal to 1 into OSPF. These routes will be redistributed into OSPF as external link state advertisements with a metric of 5, metric type of Type 1 and a tag equal to 1.

```
router ospf 109
redistribute rip route-map rip-to-ospf

route-map rip-to-ospf permit
match metric 1
set metric 5
set metric-type type1
set tag 1
```

## Related Commands

**match**
**redistribute**
**set**
**show route-map**

# router bgp

To configure the Border Gateway Protocol (BGP) routing process, use the **router bgp** global configuration command. To remove a routing process, use the **no** form of this command.

**router bgp** *autonomous-system*
**no router bgp** *autonomous-system*

## Syntax Description

| | |
|---|---|
| *autonomous-system* | Number of an autonomous system that identifies the router to other BGP routers and tags the routing information passed along. |

## Default

No BGP routing process is enabled by default.

## Command Mode

Global configuration

## Usage Guidelines

This command allows you to set up a distributed routing core that automatically guarantees the loop-free exchange of routing information between autonomous systems.

## Example

The following example configures a BGP process for autonomous system 120:

```
router bgp 120
```

## Related Commands

**neighbor**
**network** (BGP)
**timers bgp**

# router egp

To configure the Exterior Gateway Protocol (EGP) routing process, use the **router egp** global configuration command. To turn off an EGP routing process, use the **no router egp** command.

**router egp** *remote-as*
**no router egp** *remote-as*

## Syntax Description

| | |
|---|---|
| *remote-as* | Autonomous system number the router expects its peers to be advertising in their EGP messages. |

## Default

No EGP routing process is defined.

## Command Mode

Global configuration

## Usage Guidelines

You must specify the autonomous system number before starting EGP. The local autonomous system number will be included in EGP messages sent by the router. The software does not insist that the actual remote autonomous system number match the configured autonomous system numbers. The output from the **debug ip-egp** EXEC command will advise of any discrepancies.

## Example

The following example assigns a router to autonomous system 109 and is peering with routers in autonomous system 164:

```
autonomous-system 109
router egp 164
```

## Related Commands

**autonomous-system**
**neighbor**
**network** (EGP)
**timers egp**

# router egp 0

To specify that a router should be considered a core gateway, use the **router egp 0** global configuration command. To disable this function, use the **no** form of this command.

**router egp 0**
**no router egp 0**

### Syntax Description

This command has no arguments or keywords.

### Default

Disabled

### Command Mode

Global configuration

### Usage Guidelines

Core gateways are central clearinghouses of routing information. Only one core gateway process can be configured in a router.

The **router egp 0** global configuration command allows a specific router to have an EGP process that will enable it to act as a peer with any reachable autonomous system and information is exchanged freely between autonomous systems.

Normally, an EGP process expects to communicate with neighbors from a single autonomous system. Because all neighbors are in the same autonomous system, the EGP process assumes that these neighbors all have consistent internal information. Therefore, if the EGP process is informed about a route from one of its neighbors, it will not send it out to other neighbors.

With *core EGP*, the assumption is that all neighbors are from different autonomous systems, and all have inconsistent information. In this case, the EGP process distributes routes from one neighbor to all others (but not back to the originator). This allows the EGP process to be a central clearinghouse for information.

To control how an EGP process determines which neighbors will be treated as peers, use the **neighbor any** router configuration command with the **router egp 0** global configuration command.

### Example

The following example illustrates how an EGP core gateway can be configured:

```
access-list 1 permit 10.0.0.0 0.255.255.255
! global access list assignment
router egp 0
neighbor any 1
network 131.108.0.0
```

### Related Commands

**neighbor any**
**neighbor any third-party**

# router eigrp

To configure the Enhanced IGRP routing process, use the **router eigrp** global configuration command. To shut down a routing process, use the **no** form of this command.

**router eigrp** *process-id*
**no router eigrp** *process-id*

## Syntax Description

| | |
|---|---|
| *process-id* | Number of a process that identifies the routes to the other Enhanced IGRP routers. It is also used to tag the routing information. If you have an autonomous sytem number, you can use it for the process number. |

## Default

Disabled

## Command Mode

Global configuration

## Example

The following example shows how to configure an Enhanced IGRP routing process and assign process number 109:

```
router eigrp 109
```

## Related Command

**network** (Enhanced IGRP)

# router igrp

To configure the Interior Gateway Routing Protocol (IGRP) routing process, use the **router igrp** global configuration command. To shut down an IGRP routing process, use the **no** form of this command.

**router igrp** *process-id*
**no router igrp** *process-id*

## Syntax Description

| | |
|---|---|
| *process-id* | Number of a process that identifies the routes to the other IGRP routers. It is also used to tag the routing information. If you have an autonomous sytem number, you can use it for the process number. |

## Default

No IGRP routing process is defined.

## Command Mode

Global configuration

## Example

The following example shows how to configure an IGRP routing process and assign process number 109:

```
router igrp 109
```

## Related Command

**network** (IGRP)

# router isis

To enable the IS-IS routing protocol and to specify an IS-IS process for IP, use the **router isis** global configuration command. To disable IS-IS routing, use the **no** form of this command.

**router isis** [*tag*]
**no router isis** [*tag*]

## Syntax Description

| | |
|---|---|
| *tag* | (Optional) Meaningful name for a routing process. If it is not specified, a null tag is assumed and the process is referenced with a null tag. This name must be unique among all IP router processes for a given router. |

## Default

Disabled

## Command Mode

Global configuration

## Usage Guidelines

You can specify only one IS-IS process per router. Only one IS-IS process is allowed whether you run it in integrated mode, ISO CLNS only, or IP only.

## Example

The following example configures the router for IP routing and enables the IS-IS routing protocol:

```
ip routing
router isis
```

## Related Commands

**ip router isis**
**net**

# router ospf

To configure an OSPF routing process, use the **router ospf** global configuration command. To terminate an OSPF routing process, use the **no** form of this command.

**router ospf** *process-id*
**no router ospf** *process-id*

### Syntax Description

| | |
|---|---|
| *process-id* | Internally used identification parameter for an OSPF routing process. It is locally assigned and can be any positive integer. A unique value is assigned for each OSPF routing process. |

### Default

No OSPF routing process is defined.

### Command Mode

Global configuration

### Usage Guidelines

You can specify multiple OSPF routing processes in each router.

### Example

The following example shows how to configure an OSPF routing process and assign a process number of 109:

```
router ospf 109
```

### Related Command

**network** (OSPF)

# router rip

To configure the Routing Information Protocol (RIP) routing process, use the **router rip** global configuration command. To turn off the RIP routing process, use the **no** form of this command.

**router rip**
**no router rip**

## Syntax Description

This command has no arguments or keywords.

## Default

No RIP routing process is defined.

## Command Mode

Global configuration

## Example

The following example shows how to begin the RIP routing process:

```
router rip
```

## Related Command

**network** (RIP)

# set automatic-tag

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

**set automatic-tag**
**no set automatic-tag**

## Syntax Description

This command has no arguments or keywords.

## Default

Disabled

## Command Mode

Route-map configuration

## Usage Guidelines

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

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

## Example

In the following example, the router is configured to automatically compute the tag value for the BGP learned routes.

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

## Related Commands

**match**
**route-map**

# set level

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

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

## Syntax Description

| | |
|---|---|
| **level-1** | Import into a Level-1 area |
| **level-2** | Import into Level-2 sub-domain |
| **level-1-2** | Import into Level-1 and Level-2 |
| **stub-area** | Import into OSPF NSSA area |
| **backbone** | Import into OSPF backbone area |

## Default

Disabled

For IS-IS destinations, the default value is **level-2**. For OSPF destinations, the default value is **backbone**.

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

## Example

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

```
route-map name
set level level-l
```

## Related Commands

**route-map**
**match**

# set local-preference

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

**set local-preference** *value*
**no set local-preference** *value*

### Syntax Description

| | |
|---|---|
| *value* | Preference value. An integer from 0 through 4294967295. |

### Default

Preference value of 100

### Command Mode

Route-map configuration

### Usage Guidelines

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

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

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

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

### Example

In the following example, the local preference of is set to 100 for all routes that are included in access list 1:

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

### Related Commands

**match**
**route-map**

# set metric

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

**set metric** *metric-value*
**no set metric** *metric-value*

## Syntax Description

| | |
|---|---|
| *metric-value* | Metric value or IGRP bandwidth in kilobits per second. It can be an integer from 0 through 294967295. |

## Default

Default metric value.

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

## Example

In the following example, the metric value for the destination routing protocol is set to 100:

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

## Related Commands

**match**
**route-map**

# set metric-type

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

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

## Syntax Description

| | |
|---|---|
| **internal** | IS-IS internal metric |
| **external** | IS-IS external metric |
| **type-1** | OSPF external type 1 metric |
| **type-2** | OSPF external type 2 metric |

## Default

Disabled

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

## Example

In the following example, the metric type of the destination protocol is set to OSPF external type 1:

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

## Related Commands

**match**
**route-map**

# set next-hop

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

**set next-hop** *next-hop*
**no set next-hop** *next-hop*

### Syntax Description

| | |
|---|---|
| *next-hop* | IP address of the next hop router |

### Default

Default next-hop address.

### Command Mode

Route-map configuration

### Usage Guidelines

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

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

### Example

In the following example, routes that pass the access list have the next hop set to 198.92.70.24:

```
route-map map_hop
match address 5
set next-hop 198.92.70.24
```

### Related Commands

**match**
**route-map**

# set origin

To set the BGP origin code, use the **set origin** route-map configuration command. To delete an entry, use the **no** form of this command .

**set origin** {**igp** | **egp** *autonomous-system* | **incomplete**}

## Syntax Description

| | |
|---|---|
| **igp** | Remote EGP |
| **egp** | Local IGP |
| *autonomous-system* | Remote autonomous system. This is an integer from 0 through 65535. |
| **incomplete** | Unknown heritage |

## Default

Default origin, based on route in main IP routing table.

## Command Mode

Route-map configuration

## Usage Guidelines

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

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

## Example

In the following example, routes that pass the route map have the origin set to IGP:

```
route-map set_origin
match as-path 10
set origin igp
```

## Related Commands

**match**
**route-map**

# set tag

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

**set tag** *tag-value*
**no set tag** *tag-value*

## Syntax Description

| | |
|---|---|
| *tag-value* | Name for the tag. Integer from 0 through 4294967295. |

## Default

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

## Command Mode

Route-map configuration

## Usage Guidelines

Use the **route-map** global configuration command, and the route-map configuration commands **match** and **set**, 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**. The **set** commands specify the *set actions*—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

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

## Example

In the following example, the tag value of the destination routing protocol is set to 5:

```
route-map tag
set tag 5
```

## Related Commands

**match**
**route-map**

# set weight

To specify the BGP weight for the routing table, use the **set weight** route-map configuration command. To delete an entry, use the **no** form of this command.

**set weight** *weight*
**no set weight** *weight*

## Syntax Description

| | |
|---|---|
| *weight* | Weight value. It can be an integer from 0 through 65535. |

## Default

The weight is not changed by the specified route map.

## Command Mode

Route-map configuration

## Usage Guidelines

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

The implemented weight is based on the first matched autonomous system path. Weights indicated when an autonomous system path is matched override the weights assigned by global **neighbor** commands. In other words, the weights assigned with the **match as-path** and **set weight** route-map commands override the weights assigned using the **neighbor weight** and **neighbor filter-list** commands.

## Example

In the following example, the BGP weight for the routes matching the AS path access list is set to 200:

```
route-map set-weight
match as-path 10
set weight 200
```

## Related Commands

**match**
**route-map**

# show ip bgp

To display entries in the BGP routing table, use the **show ip bgp** EXEC command.

**show ip bgp** [*network*] [*network-mask*] [**subnets**]

## Syntax Description

| | |
|---|---|
| *network* | (Optional) Network number, entered to display a particular network in the BGP routing table. |
| *network-mask* | (Optional) Displays all BGP routes matching the address/mask pair. |
| **subnets** | (Optional) Displays route and more specific routes. |

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip bgp** command:

```
Router# show ip bgp
BGP table version is 716977, local router ID is 193.0.32.1
Status codes: s suppressed, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
* i3.0.0.0         193.0.22.1             0    100      0 1800 1239 ?
*>i                193.0.16.1             0    100      0 1800 1239 ?
* i6.0.0.0         193.0.22.1             0    100      0 1800 690 568 ?
*>i                193.0.16.1             0    100      0 1800 690 568 ?
* i7.0.0.0         193.0.22.1             0    100      0 1800 701 35 ?
*>i                193.0.16.1             0    100      0 1800 701 35 ?
*                  198.92.72.24                        0 1878 704 701 35 ?
* i8.0.0.0         193.0.22.1             0    100      0 1800 690 560 ?
*>i                193.0.16.1             0    100      0 1800 690 560 ?
*                  198.92.72.24                        0 1878 704 701 560 ?
* i13.0.0.0        193.0.22.1             0    100      0 1800 690 200 ?
*>i                193.0.16.1             0    100      0 1800 690 200 ?
*                  198.92.72.24                        0 1878 704 701 200 ?
* i15.0.0.0        193.0.22.1             0    100      0 1800 174 ?
*>i                193.0.16.1             0    100      0 1800 174 ?
* i16.0.0.0        193.0.22.1             0    100      0 1800 701 i
*>i                193.0.16.1             0    100      0 1800 701 i
*                  198.92.72.24                        0 1878 704 701 i
```

Table 17-6 describes significant fields shown in the display.

**Table 17-6 Show IP BGP Field Descriptions**

| Field | Description |
|---|---|
| BGP table version | Internal version number of the table. This number is incremented whenever the table changes. |
| local router ID | IP address of the router. |
| Status codes | Status of the table entry. The status is displayed at the beginning of each line in the table. It can be one of the following values: |
| s suppressed | Entry is suppressed. |
| * valid | Entry is valid. |
| > best | Entry is the best to use for that network. |
| i -internal | Entry learned via an internal BGP session. |
| Origin codes | Indicates the origin of the entry. The origin code is placed at the end of each line in the table. It can be one of the following values: |
| i - IGP | Entry originated from IGP and wa sadvertised with a **network** router configuration command. |
| e - EGP | Entry originated from EGP. |
| ? - incomplete | Origin of the path is not clear Usually, this is a router that is redistributed into BGP from an IGP. |
| Network | IP address of a network entity. |
| Next Hop | IP address of the next system that is used when forwarding a packet to the destination network. An entry of 0.0.0.0 indicates that the router has some non-BGP routes to this network. |
| Metric | If shown, this is the value of the interautonomous system metric. This is frequently not used. |
| LocPrf | Local preference value as set with the **set local-preference** route-map configuration command. The default value is 100. |
| Weight | Weight of the route as set via autonomous system filters. |
| Path | Autonomous system paths to the destination network. There can be one entry in this field for each autonomous system in the path. |

The following is sample output from the **show ip bgp subnets** command:

```
Router# show ip bgp 198.92.0.0 255.255.0.0 subnets
BGP table version is 1738, local router ID is 198.92.72.24
Status codes: s suppressed, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 198.92.0.0       198.92.72.30        8896         32768 ?
*                   198.92.72.30                         0 109 108 ?
*> 198.92.1.0       198.92.72.30        8796         32768 ?
*                   198.92.72.30                         0 109 108 ?
*> 198.92.11.0      198.92.72.30       42482         32768 ?
*                   198.92.72.30                         0 109 108 ?
*> 198.92.14.0      198.92.72.30        8796         32768 ?
*                   198.92.72.30                         0 109 108 ?
*> 198.92.15.0      198.92.72.30        8696         32768 ?
*                   198.92.72.30                         0 109 108 ?
*> 198.92.16.0      198.92.72.30        1400         32768 ?
*                   198.92.72.30                         0 109 108 ?
*> 198.92.17.0      198.92.72.30        1400         32768 ?
```

```
*                  198.92.72.30                         0 109 108 ?
*> 198.92.18.0     198.92.72.30        8876         32768 ?
*                  198.92.72.30                         0 109 108 ?
*> 198.92.19.0     198.92.72.30        8876         32768 ?
*                  198.92.72.30                         0 109 108 ?
```

# show ip bgp cidr-only

To display routes with non natural network masks, use the **show ip bgp cidr-only** privileged EXEC command.

**show ip bgp cidr-only**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

Privileged EXEC

## Sample Display

The following is sample output from the **show ip bgp cidr-only** command:

```
Router# show ip bgp cidr-only
BGP table version is 220, local router ID is 198.92.73.131
Status codes: s suppressed, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 192.0.0.0/8      198.92.72.24                         0 1878 ?
*> 198.92.0.0/16    198.92.72.30                         0 108 ?
```

# show ip bgp filter-list

To display routes that conform to a specified filter list, use the **show ip bgp filter-list** privileged EXEC command.

**show ip bgp filter-list** *access-list-number*

## Syntax Description

| | |
|---|---|
| *access-list-number* | Number of an access list. It can be a number from 1 through 199. |

## Command Mode

Privileged EXEC

## Sample Display

The following is sample output from the **show ip bgp filter-list** command:

```
Router# show ip bgp filter-list 2
BGP table version is 1738, local router ID is 198.92.72.24
Status codes: s suppressed, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*  198.92.0.0       198.92.72.30                         0 109 108 ?
*  198.92.1.0       198.92.72.30                         0 109 108 ?
*  198.92.11.0      198.92.72.30                         0 109 108 ?
*  198.92.14.0      198.92.72.30                         0 109 108 ?
*  198.92.15.0      198.92.72.30                         0 109 108 ?
*  198.92.16.0      198.92.72.30                         0 109 108 ?
*  198.92.17.0      198.92.72.30                         0 109 108 ?
*  198.92.18.0      198.92.72.30                         0 109 108 ?
*  198.92.19.0      198.92.72.30                         0 109 108 ?
*  198.92.24.0      198.92.72.30                         0 109 108 ?
*  198.92.29.0      198.92.72.30                         0 109 108 ?
*  198.92.30.0      198.92.72.30                         0 109 108 ?
*  198.92.33.0      198.92.72.30                         0 109 108 ?
*  198.92.35.0      198.92.72.30                         0 109 108 ?
*  198.92.36.0      198.92.72.30                         0 109 108 ?
*  198.92.37.0      198.92.72.30                         0 109 108 ?
*  198.92.38.0      198.92.72.30                         0 109 108 ?
*  198.92.39.0      198.92.72.30                         0 109 108 ?
```

# show ip bgp neighbors

To display information about the TCP and BGP connections to individual neighbors, use the **show ip bgp neighbors** EXEC command.

**show ip bgp neighbors** [*address*] [**routes** | **paths**]

## Syntax Description

| | |
|---|---|
| *address* | (Optional) Address of the neighbor whose routes you have learned from |
| **routes** | (Optional) Displays routes to specified neighbors |
| **paths** | (Optional) Displays autonomous system paths to specified neighbor |

## Command Mode

EXEC

## Sample Displays

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

```
Router# show ip bgp neighbors

BGP neighbor is 131.108.6.68, remote AS 10, external link
BGP version 3, remote router ID 131.108.6.68
BGP state = Established, table version = 22, up for 0:00:13
Last read 0:00:12, hold time is 180, keepalive interval is 60 seconds
Received 24 messages, 0 notifications
Sent 28 messages, 4 notifications
Connections established 1; dropped 0
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Local host: 131.108.6.69, 12288   Foreign host: 131.108.6.68, 179

Enqueued packets for retransmit: 0, input: 0, saved: 0

Event Timers (current time is 835828):
Timer:       Retrans   TimeWait    AckHold    SendWnd  KeepAlive
Starts:           20          0         18          0          0
Wakeups:           1          0          2          0          0
Next:              0          0          0          0          0

iss:      60876  snduna:      62649  sndnxt:      62649     sndwnd:   1872
irs:   95187024  rcvnxt:   95188733  rcvwnd:       1969  delrcvwnd:    271

SRTT: 364 ms, RTTO: 1691 ms, RTV: 481 ms, KRTT: 0 ms
minRTT: 4 ms, maxRTT: 340 ms, ACK hold: 300 ms
Flags: higher precedence

Datagrams (max data segment is 1450 bytes):
Rcvd: 36 (out of order: 0), with data: 18, total data bytes: 1708
Sent: 40 (retransmit: 1), with data: 36, total data bytes: 1817
```

Table 17-7 describes the fields shown in the display.

**Table 17-7 Show IP BGP Neighbors Field Descriptions**

| Field | Description |
|---|---|
| BGP neighbor | Lists the IP address of the BGP neighbor and its autonomous system number. If the neighbor is in the same autonomous system as the router, then the link between them is internal. Otherwise, it is considered external. |
| BGP version | Specifies that the BGP version being used to communicate with the remote router is BGP version 3; the neighbor's router ID (an IP address) is also specified. |
| BGP state | Indicates the internal state of this BGP connection. |
| table version | Indicates that the neighbor has been updated with this version of the primary BGP routing table. |
| up time | Indicates the amount of time that the underlying TCP connection has been in existence. |
| Last read | Time that BGP last read a message from this neighbor. |
| hold time | Maximum amount of time that can elapse between messages from the peer. |
| keepalive interval | Time period between sending keepalive packets, which help ensure that the TCP connection is up. |
| Received | Number of received messages indicates the number of total BGP messages received from this peer, including keepalives. The number of notifications is the number of error messages received from the peer. |
| Sent | The number of sent messages indicates the total number of BGP messages that have been sent to this peer, including keepalives. The number of notifications is the number of error messages that we have sent to this peer. |
| Connections established | The number of connections established is a count of the number of times that we have established a TCP connection and the two peers have agreed speak BGP with each other. The number of dropped connections is the number of times that a good connection has failed or been taken down. |

The remainder of the display describes the status of the underlying TCP connection.

The following is sample output from the **show ip bgp neighbors** command when you specify the **routes** keyword:

```
Router# show ip bgp neighbors 198.41.177.210 routes
BGP table version is 212136, local router ID is 131.108.5.225
Status codes: s suppressed, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop         Metric LocPrf Weight Path
*> 163.179.0.0      192.41.177.210                    100 2551 i
*  192.203.50.0     192.41.177.210                    100 2551 ?
*> 199.183.0.0/16   192.41.177.210                    100 2551 i
```

Table 17-8 describes the fields shown in the display.

**Table 17-8 Show IP BGP Neighbors Field Descriptions When You Specify the Routes Keyword**

| Field | Description |
|---|---|
| BGP table version | Internal version number of the table. This number is incremented whenever the table changes. |
| local router ID | IP address of the router. |
| Status codes | Status of the table entry. The status is displayed at the beginning of each line in the table. It can be one of the following values: |
| s suppressed | Entry is suppressed. |
| * valid | Entry is valid. |
| > best | Entry is the best to use for that network. |
| i -internal | Entry learned via an internal BGP session. |
| Origin codes | Indicates the origin of the entry. The origin code is placed at the end of each line in the table. It can be one of the following values: |
| i - IGP | Entry originated from IGP and wa sadvertised with a **network** router configuration command. |
| e - EGP | Entry originated from EGP. |
| ? - incomplete | Origin of the path is not clear Usually, this is a router that is redistributed into BGP from an IGP. |
| Network | IP address of a network entity. |
| Next Hop | IP address of the next system that is used when forwarding a packet to the destination network. An entry of 0.0.0.0 indicates that the router has some non-BGP routes to this network. |
| Metric | If shown, this is the value of the interautonomous system metric. This is frequently not used. |
| LocPrf | Local preference value as set with the **set local-preference** route-map configuration command. The default value is 100. |
| Weight | Weight of the route as set via autonomous system filters. |
| Path | Autonomous system paths to the destination network. There can be one entry in this field for each autonomous system in the path. |

# show ip bgp paths

To display all the BGP paths in the database, use the **show ip bgp paths** EXEC command.

**show ip bgp paths**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip bgp paths** command:

```
Router# show ip bgp paths

Address    Hash Refcount Metric Path
0x297A9C      0        2      0 i
0x30BF84      1        0      0 702 701 ?
0x2F7BC8      2      235      0 ?
0x2FA1D8      3        0      0 702 701 i
```

Table 17-9 describes significant fields shown in the display.

**Table 17-9 Show IP BGP Paths Field Descriptions**

| Field | Description |
|---|---|
| Address | Internal address where the path is stored. |
| Hash | Hash bucket where path is stored. |
| Refcount | Number of routes using that path. |
| Metric | The MULTI_EXIT_DISC metric for the path. (The name of this metric for BGP versions 2 and 3 is INTER_AS.) |
| Path | The AS_PATH for that route, followed by the origin code for that route. |

# show ip bgp regexp

To display routes matching the regular expression, use the **show ip bgp regexp** privileged EXEC command.

**show ip bgp regexp** *regular-expression*

## Syntax Description

| | |
|---|---|
| *regular-expression* | Regular expression to match the BGP autonomous system paths |

## Command Mode

Privileged EXEC

## Sample Display

```
Router# show ip bgp regexp 108$
BGP table version is 1738, local router ID is 198.92.72.24
Status codes: s suppressed, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*  198.92.0.0       198.92.72.30                         0 109 108 ?
*  198.92.1.0       198.92.72.30                         0 109 108 ?
*  198.92.11.0      198.92.72.30                         0 109 108 ?
*  198.92.14.0      198.92.72.30                         0 109 108 ?
*  198.92.15.0      198.92.72.30                         0 109 108 ?
*  198.92.16.0      198.92.72.30                         0 109 108 ?
*  198.92.17.0      198.92.72.30                         0 109 108 ?
*  198.92.18.0      198.92.72.30                         0 109 108 ?
*  198.92.19.0      198.92.72.30                         0 109 108 ?
*  198.92.24.0      198.92.72.30                         0 109 108 ?
*  198.92.29.0      198.92.72.30                         0 109 108 ?
*  198.92.30.0      198.92.72.30                         0 109 108 ?
*  198.92.33.0      198.92.72.30                         0 109 108 ?
*  198.92.35.0      198.92.72.30                         0 109 108 ?
*  198.92.36.0      198.92.72.30                         0 109 108 ?
*  198.92.37.0      198.92.72.30                         0 109 108 ?
*  198.92.38.0      198.92.72.30                         0 109 108 ?
*  198.92.39.0      198.92.72.30                         0 109 108 ?
```

# show ip bgp summary

To display the status of all BGP connections, use the **show ip bgp summary** EXEC command.

**show ip bgp summary**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip bgp summary** command:

```
Router# show ip bgp summary
BGP table version is 717029, main routing table version 717029
19073 network entries (37544 paths) using 3542756 bytes of memory
691 BGP path attribute entries using 57200 bytes of memory

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State
193.0.16.1      4  1755   32642    2973   717029    0    0 1:27:11
193.0.17.1      4  1755    4790    2973   717029    0    0 1:27:51
193.0.18.1      4  1755    7722    3024   717029    0    0 1:28:13
193.0.19.1      4  1755       0       0        0    0    0 2d02     Active
193.0.20.1      4  1755    3673    3049   717029    0    0 2:50:10
193.0.21.1      4  1755    3741    3048   717029    0    0 12:24:43
193.0.22.1      4  1755   33129    3051   717029    0    0 12:24:48
193.0.23.1      4  1755       0       0        0    0    0 2d02     Active
193.0.24.1      4  1755       0       0        0    0    0 2d02     Active
193.0.25.1      4  1755       0       0        0    0    0 2d02     Active
193.0.26.1      4  1755       0       0        0    0    0 2d02     Active
193.0.27.1      4  1755    4269    3049   717029    0    0 12:39:33
193.0.28.1      4  1755    3037    3050   717029    0    0 2:08:15
198.92.72.24    4  1878   11635   13300   717028    0    0 0:50:39
```

Table 17-10 describes significant fields shown in the display.

**Table 17-10 Show IP BGP Summary Field Descriptions**

| Field | Description |
|---|---|
| BGP table version | Internal version number of BGP database. |
| main routing table version | Indicates last version of BGP database that was injected into main routing table. |
| Neighbor | IP address of a neighbor. |
| V | Indicates BGP version number spoken to that neighbor. |
| MsgRcvd | BGP messages received from that neighbor. |
| MsgSent | BGP messages sent to that neighbor. |
| TblVer | Last version of the BGP database that was sent to that neighbor. |

| Field | Description |
|---|---|
| InQ | Number of messages from that neighbor waiting to be processed. |
| OutQ | Number of messages waiting to be sent to that neighbor. |
| Update/State | The length of time that the BGP session has been in state Established, or the current state if it is not Established. |

# show ip dvmrp route

To display the contents of the DVMRP routing table, use the **show ip dvmrp route** EXEC command.

**show ip dvmrp route** [*ip-address*]

## Syntax Description

| | |
|---|---|
| *ip-address* | (Optional) IP address of an entry in the DVMRP routing table. |

## Command Mode

EXEC

## Sample Display

The following is sample output of the **show ip dvmrp route** command:

```
DVMRP Routing Table - 3 entries
13.0.32.0/22 [0/11]
  via 192.88.195.10, Tunnel1, uptime 3:50:24, expires 0:02:24
13.0.52.0/22 [0/9]
  via 192.88.195.10, Tunnel1, uptime 0:59:14, expires 0:02:24
13.1.68.0/22 [0/8]
  via 192.88.195.10, Tunnel1, uptime 3:50:24, expires 0:02:24
```

Table 17-11 describes the fields shown in the display

**Table 17-11 Show IP DVMRP Route Field Descriptions**

| Field | Description |
|---|---|
| 3 entries | Number of entries in the DMVRP routing table. |
| 13.0.32.0/22 | Source network. |
| [0/11] | Administrative distance/reliability. |
| via 192.88.195.10 | Next-hop router to the source network. |
| Tunnel1 | Interface to the source network. |
| uptime | How long in hours, minutes, and seconds that the route has been in the DVMRP routing table. |
| expires | How long in hours, minutes, and seconds until the entry is removed from the DVMRP routing table. |

## Related Command

**ip dvmrp accept-filter**

# show ip egp

To display statistics about EGP connections and neighbors, use the **show ip egp** EXEC command.

**show ip egp**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip egp** command:

```
Router# show ip egp

Local autonomous system is 109
  EGP Neighbor FAS/LAS State   SndSeq RcvSeq Hello Poll j/k Flags
  10.3.0.27      1/109 IDLE       625  61323    60  180   0 Perm, Act
* 10.2.0.37      1/109 UP 12:29   250  14992    60  180   3 Perm, Act
* 10.7.0.63      1/109 UP  1d19   876  10188    60  180   4 Perm, Pass
```

Table 17-12 describes the fields shown in the display.

**Table 17-12 Show IP EGP Field Descriptions**

| Field | Description |
|---|---|
| EGP Neighbor | Address of the EGP neighbor. |
| FAS | Foreign autonomous system number. |
| LAS | Local autonomous system number. |
| State | State of the connection between peers. |
| SndSeq | Send sequence number. |
| RcvSeq | Receive sequence number. |
| Hello | Interval between Hello/I-Heard-You packets. |
| Poll | Interval between Poll/Update packets. |
| j/k | Measure of reachability; 4 is perfect. |
| Flags | Perm—Permanent.<br>Temp—Temporary (neighbor will be removed).<br>Act—Active, controlling the connection.<br>Pass—Passive, neighbor controls the connection. |

# show ip eigrp neighbors

To display the neighbors discovered by Enhanced IGRP, use the **show ip eigrp neighbors** EXEC command.

**show ip eigrp neighbors** [*interface*]

## Syntax Description

| | |
|---|---|
| *interface* | (Optional) Interface name and number |

## Command Mode

EXEC

## Usage Guidelines

Use the **show ip eigrp neighbors** command to determine when neighbors become active and inactive. It is also useful for debugging certain types of transport problems.

## Sample Display

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

```
Router# show ip eigrp neighbors
IP-EIGRP Neighbors for process 77
Address                 Interface     Holdtime Uptime   Q      Seq  SRTT  RTO
                                      (secs)   (h:m:s)  Count  Num  (ms)  (ms)
160.89.81.28            Ethernet1     13       0:00:41  0      11   4     20
160.89.80.28            Ethernet0     14       0:02:01  0      10   12    24
160.89.80.31            Ethernet0     12       0:02:02  0      4    5     20
```

Table 17-13 explains the fields in the output.

**Table 17-13 Show IP EIGRP Neighbors Field Descriptions**

| Field | Description |
|---|---|
| process 77 | Autonomous system number specified in the **ipx router** configuration command. |
| Address | IP address of the enhanced IGRP peer. |
| Interface | Interface on which the router is receiving hello packets from the peer. |
| Holdtime | Length of time, in seconds, that the router will wait to hear from the peer before declaring it down. If the peer is using the default hold time, this number will be less than 15. If the peer configures a nondefault hold time, it will be reflected here. |
| Uptime | Elapsed time, in hours, minutes, and seconds, since the local router first heard from this neighbor. |
| Q Count | Number of Enhanced IGRP packets (Update, Query, and Reply) that the router is waiting to send. |

| Field | Description |
|---|---|
| Seq Num | Sequence number of the last update, query, or reply packet that was received from this neighbor. |
| SRTT | Smooth round-trip time. This is the number of milliseconds it takes for an Enhanced IGRP packet to be sent to this neighbor and for the local router to receive an acknowledgment of that packet. |
| RTO | Retransmission timeout, in milliseconds. This is the amount of time the router waits before retransmitting a packet from the retransmission queue to a neighbor. |

# show ip eigrp topology

To display the Enhanced IGRP topology table, use the **show ip eigrp topology** EXEC command.

**show ip eigrp topology** [*autonomous-system-number* | [[*ip-address*]*mask*]]

## Syntax Description

| | |
|---|---|
| *autonomous-system-number* | (Optional) Autonomous system number. |
| *ip-address* | (Optional) IP address. When specified with a mask, a detailed description of the entry is provided. |
| *mask* | (Optional) Subnet mask. |

## Command Mode

EXEC

## Usage Guidelines

Use the **show ip eigrp topology** command to determine DUAL states and to debug possible DUAL problems.

## Sample Display

The following is sample output from the **show ip eigrp topology** command:

```
Router# show ip eigrp topology
IP-EIGRP Topology Table for process 77

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - Reply status

P 160.89.90.0 255.255.255.0, 2 successors, FD is 0
          via 160.89.80.28 (46251776/46226176), Ethernet0
          via 160.89.81.28 (46251776/46226176), Ethernet1
          via 160.89.80.31 (46277376/46251776), Ethernet0
P 160.89.81.0 255.255.255.0, 1 successors, FD is 307200
          via Connected, Ethernet1
          via 160.89.81.28 (307200/281600), Ethernet1
          via 160.89.80.28 (307200/281600), Ethernet0
          via 160.89.80.31 (332800/307200), Ethernet0
```

Table 17-14 explains the fields in the output.

**Table 17-14 Show IP EIGRP Topology Field Descriptions**

| Field | Description |
|---|---|
| Codes | State of this topology table entry. Passive and Active refer to the enhanced IGRP state with respect to this destination; Update, Query, and Reply refer to the type of packet that is being sent. |
| P – Passive | No enhanced IGRP computations are being performed for this destination. |
| A – Active | Enhanced IGRP computations are being performed for this destination. |
| U – Update | Indicates that an update packet was sent to this destination. |

| Field | Description |
|---|---|
| Q – Query | Indicates that a query packet was sent to this destination. |
| R – Reply | Indicates that a reply packet was sent to this destination. |
| r – Reply status | Flag that is set when after the router has sent a query and is waiting for a reply. |
| 160.89.90.0 and so on | Destination IP network number. |
| 255.255.255.0 | Destination subnet mask. |
| successors | Number of successors. This number corresponds to the number of next hops in the IP routing table. |
| FD | Feasible distance. This value is used in the feasibility condition check. If the neighbor's reported distance (the metric after the slash) is less than the feasible distance, the feasibility condition is met and that path is a feasible successor. Once the router determines it has a feasible successor, it does not have to send a query for that destination. |
| replies | Number of replies that are still outstanding (have not been received) with respect to this destination. This information appears only when the destination is in Active state. |
| state | Exact enhanced IGRP state that this destination is in. It can be the number 0, 1, 2, or 3. This information appears only when the destination is Active. |
| via | IP address of the peer who told the router about this destination. The first N of these entries, where N is the number of successors, are the current successors. The remaining entries on the list are feasible successors. |
| (46251776/46226176) | The first number is the enhanced IGRP metric that represents the cost to the destination. The second number is the enhanced IGRP metric that this peer advertised. |
| Ethernet0 | Interface from which this information was learned. |

# show ip eigrp traffic

To display the number of Enhanced IGRP packets sent and received, use the **show ip eigrp traffic** EXEC command.

**show ip eigrp traffic** [*autonomous-system-number*]

## Syntax Description

| | |
|---|---|
| *autonomous-system-number* | (Optional) Autonomous system number |

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip eigrp traffic** command:

```
Router# show ip eigrp traffic
IP-EIGRP Traffic Statistics for process 77
  Hellos sent/received: 218/205
  Updates sent/received: 7/23
  Queries sent/received: 2/0
  Replies sent/received: 0/2
  Acks sent/received: 21/14
```

Table 17-15 describes the fields that might be shown in the display.

**Table 17-15 Show IP EIGRP Traffic Field Descriptions**

| Field | Description |
|---|---|
| process 77 | Autonomous system number specified in the **ip router** command. |
| Hellos sent/received | Number of hello packets that were sent and received. |
| Updates sent/received | Number of update packets that were sent and received. |
| Queries sent/received | Number of query packets that were sent and received. |
| Replies sent/received | Number of reply packets that were sent and received. |
| Acks sent/received | Number of acknowledgment packets that were sent and received. |

# show ip igmp groups

To display the multicast groups that are directly connected to the router and that were learned via IGMP, use the **show ip igmp groups** EXEC command.

**show ip igmp groups** [*group-name* | *group-address* | *interface*]

## Syntax Description

| | |
|---|---|
| *group-name* | (Optional) Name of the multicast group, as defined in the DNS hosts table. |
| *group-address* | (Optional) Address of the multicast group. This is a multicast IP address in four-part dotted notation. |
| *interface* | (Optional) Interface type and number. |

## Command Mode

EXEC

## Usage Guidelines

If you omit all optional arguments, the **show ip igmp groups** command displays by group address and interface type and number all directly connected multicast groups.

## Sample Display

The following is sample output from the **show ip igmp groups** command:

```
Router# show ip igmp groups
IGMP Connected Group Membership
Group Address    Interface       Uptime    Expires   Last Reporter
224.0.255.1      Ethernet0       18:51:41  0:02:15   198.92.37.192
224.2.226.60     Ethernet0       1:51:31   0:02:17   198.92.37.192
224.2.127.255    Ethernet0       18:51:45  0:02:17   198.92.37.192
226.2.2.2        Ethernet1       18:51:47  never     0.0.0.0
224.2.0.1        Ethernet0       18:51:43  0:02:14   198.92.37.192
225.2.2.2        Ethernet0       18:51:43  0:02:21   198.92.37.33
225.2.2.2        Ethernet1       18:51:47  never     0.0.0.0
225.2.2.4        Ethernet0       18:18:02  0:02:20   198.92.37.192
225.2.2.4        Ethernet1       18:23:32  0:02:55   198.92.36.128
```

Table 17-16 describes the fields shown in the display.

**Table 17-16 Show IP IGMP Groups Field Descriptions**

| Field | Description |
|---|---|
| Group address | Address of the multicast group. |
| Interface | Interface through which the group is reachable. |
| Uptime | How long in hours, minutes, and seconds this multicast group has been known. |
| Expires | How long in hours, minutes, and seconds until the entry is removed from the IGMP groups table. |
| Last Reporter | Last host to report being a member of the multicast group. |

## Related Commands

**ip igmp query-interval**

# show ip igmp interface

To display multicast-related information about an interface, use the **show ip igmp interface** EXEC command.

**show ip igmp interface** [*type number*]

## Syntax Description

| | |
|---|---|
| *type* | (Optional) Interface type |
| *number* | (Optional) Interface number |

## Command Mode

EXEC

## Usage Guidelines

If you omit the optional arguments, the **show ip igmp interface** command displays information about all interfaces.

This command also displays information about dynamically learned DVMRP routers on the interface.

## Sample Display

The following is sample output from the **show ip igmp interface** command:

```
Router# show ip igmp interface
Ethernet0 is up, line protocol is up
  Internet address is 198.92.37.6, subnet mask is 255.255.255.0
  IGMP is enabled on interface
  IGMP query interval is 60 seconds
  Inbound IGMP access group is not set
  Multicast routing is enabled on interface
  Multicast TTL threshold is 0
  Multicast designated router (DR) is 198.92.37.33
  No multicast groups joined
Ethernet1 is up, line protocol is up
  Internet address is 198.92.36.129, subnet mask is 255.255.255.0
  IGMP is enabled on interface
  IGMP query interval is 60 seconds
  Inbound IGMP access group is not set
  Multicast routing is enabled on interface
  Multicast TTL threshold is 0
  Multicast designated router (DR) is 198.92.36.131
  Multicast groups joined: 225.2.2.2 226.2.2.2
Tunnel0 is up, line protocol is up
  Internet address is 10.1.37.2, subnet mask is 255.255.0.0
  IGMP is enabled on interface
  IGMP query interval is 60 seconds
  Inbound IGMP access group is not set
  Multicast routing is enabled on interface
  Multicast TTL threshold is 0
  No multicast groups joined
```

Table 17-17 describes the fields shown in the display.

**Table 17-17 Show IP IGMP Interface Field Descriptions**

| Field | Description |
|---|---|
| Ethernet0 is up, line protocol is up | Interface type, number, and status. |
| Internet address is...<br>subnet mask is... | Internet address of the interface and subnet mask being applied to the interface, as specified with the **ip address** interface configuration command. |
| IGMP is enabled on interface | Indicates whether IGMP has been enabled on the interface with the **ip pim** interface configuration command. |
| IGMP query interval is 60 seconds | Interval at which the router sends PIM router-query messages, as specified with the **ip igmp query-interval** interface configuration command. |
| Inbound IGMP access group is not set | Indicates whether an IGMP access group has been configured with the **ip igmp access-group** interface configuration command. |
| Multicast routing is enabled on interface | Indicates whether multicast routing has been enabled on the interface with the **ip pim** interface configuration command. |
| Multicast TTL threshold is 0 | Packet time-to-threshold, as specified with the **ip multicast-threshold** interface configuration command. |
| Multicast designated router (DR) is... | IP address of the designated router for this LAN segment (subnet). |
| Multicast groups joined:<br>No multicast groups joined | Indicates whether this interface is a member of any multicast groups and, if so, lists the IP addresses of the groups. |

## Related Commands

**ip address**
**ip igmp access-group**
**ip igmp query-interval**
**ip multicast-threshold**
**ip pim**

# show ip irdp

To display IRDP values, use the **show ip irdp** EXEC command.

**show ip irdp**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip irdp** command:

```
Router# show ip irdp

Ethernet 0 has router discovery enabled

Advertisements will occur between every 450 and 600 seconds.
Advertisements are valid for 1800 seconds.
Default preference will be 100.
 --More--
Serial 0 has router discovery disabled
 --More--
Ethernet 1 has router discovery disabled
```

As the display shows, **show ip irdp** output indicates whether router discovery has been configured for each router interface, and lists the values of router discovery configurables for those interfaces on which router discovery has been enabled. Explanations for the less self-evident lines of output in the display follow.

```
Advertisements will occur between every 450 and 600 seconds.
```

Indicates the configured minimum and maximum advertising interval for the interface.

```
Advertisements are valid for 1800 seconds.
```

Indicates the configured holdtime values for the interface.

```
Default preference will be 100.
```

Indicates the configured (or in this case default) preference value for the interface.

# show ip mroute

To display the contents of the IP multicast routing table, use the **show ip mroute** EXEC command.

**show ip mroute** [*group-name* | *group-address*] [**summary**] [**count**]
**show ip mroute** [*group-name* [*source-address*] | *group-address* [*source-address*]]

## Syntax Description

| | |
|---|---|
| *group-name* | (Optional) Name of the multicast group, as defined in the DNS hosts table. |
| *group-address* | (Optional) Address of the multicast group. This is a multicast IP address in four-part dotted notation. |
| **summary** | (Optional) Displays a one-line, abbreviated summary of each entry in the IP multicast routing table. |
| **count** | (Optional) Displays statistics about the group, source router, and multicast packets. |
| *source-address* | (Optional) Address of a router that is a member of the multicast group. |

## Command Mode

EXEC

## Usage Guidelines

If you omit all optional arguments and keywords, the **show ip mroute** command displays all entries in the IP multicast routing table.

The router populates the multicast routing table by creating source, group (S,G) entries from star, group (*,G) entries. The star refers to all source addresses, the “S” refers to a single source address, and the “G” is the destination multicast group address. In creating (S,G) entries, the router uses the best path to that destination group found in the unicast routing table (that is, via Reverse Path Forwarding {RPF]).

## Sample Displays

The following is sample output from the **show ip mroute** command for a router operating is dense mode. This command displays the contents of the IP multicast routing table for the multicast group named cbone-audio.

```
Router> show ip mroute cbone-audio
IP Multicast Routing Table
Flags: P - Prune, D - Dense, S - Sparse, C - Connected, L - Local

(*, 224.0.255.1), uptime 0:57:31, expires 0:02:59, RP is 0.0.0.0, flags: DC
  Incoming interface: Null, RPF neighbor 0.0.0.0
  Outgoing interface list:
    Ethernet0, Forward state, Dense mode, uptime 0:57:31, expires 0:02:52
    Tunnel0, Forward state, Dense mode, uptime 0:56:55, expires 0:01:28

(198.92.37.100/32, 224.0.255.1), uptime 20:20:00, expires 0:02:55, flags: C
  Incoming interface: Tunnel0, RPF neighbor 10.20.37.33
  Outgoing interface list:
    Ethernet0, Forward state, Dense mode, uptime 20:20:00, expires 0:02:52
```

The following is sample output from the **show ip mroute** command for a router operating in sparse mode:

```
Router# show ip mroute
IP Multicast Routing Table
Flags: P - Prune, D - Dense, S - Sparse, C - Connected, L - Local

(*, 224.0.255.3), uptime 5:29:15, RP is 198.92.37.2, flags: SC
  Incoming interface: Tunnel0, RPF neighbor 10.3.35.1
  Outgoing interface list:
    Ethernet0, Forward state, Sparse mode, uptime 5:29:15, expires 0:02:57

(198.92.46.0/24, 224.0.255.3), uptime 5:29:15, expires 0:02:59, flags: C
  Incoming interface: Tunnel0, RPF neighbor 10.3.35.1
  Outgoing interface list:
    Ethernet0, Forward state, Sparse mode, uptime 5:29:15, expires 0:02:57
```

Table 17-18 explains the fields shown in the displays.

**Table 17-18 Show IP Mroute Field Descriptions**

| Field | Description |
|---|---|
| Flags: | Provides information about the entry. |
| P - Prune | Route has been pruned. The router keeps this information in case a downstream member wants to join the source. |
| D - Dense | Entry is operating in dense mode. |
| S - Sparse | Entry is operating in sparse mode. |
| C - Connected | A member of the multicast group is present on the directly connected interface. |
| L - Local | The router itself is a member of the multicast group. |
| (*, 224.0.255.1)<br>(198.92.37.100/32, 224.0.255.1) | Entry in the IP multicast routing table. The entry consists of the IP address of the source router followed by IP address of the multicast group. An asterisk (*) in place of the source router indicates all sources.<br>Entries in the first format are referred to as (*,G,) or “star comma G,” entries. Entries in the second format are referred to as (S,G) or (“S comma G”) entries. (*,G) entries are used to build (S,G) entries. |

| Field | Description |
|---|---|
| uptime | How long in hours, minutes, and seconds the entry has been in the IP multicast routing table. |
| expires | How long in hours, minutes, and seconds until the entry will be removed from the IP multicast routing table on the outgoing interface. |
| RP | Address of the rendezvous point (RP) router. For routers operating in sparse mode, this address is always 0.0.0.0. |
| flags: | Information about the entry. |
| Incoming interface: | Expected interface for a multicast packet from the source. If the packet is not received on this interface, it is discarded. |
| RPF neighbor | IP address of the upstream router to the source. |
| Outgoing interface list: | Interfaces through which packets will be forwarded. |
| Ethernet0 | Name and number of the outgoing interface. |
| Forward state | Indicates that packets will be forwarded on the interface if there are no restrictions due to access lists or TTL threshold. |
| Dense mode<br>Spare mode | Mode in which the interface is operating. |
| Uptime | How long in hours, minutes, and seconds the entry has been in the IP multicast routing table. |
| Expires | How long in hours, minutes, and seconds until the entry will be removed from the IP multicast routing table. |

## Related Command

**ip igmp query-interval**

# show ip ospf

To display general information about OSPF routing processes, use the **show ip ospf** EXEC command.

**show ip ospf** [*process-id*]

## Syntax Description

| | |
|---|---|
| *process-id* | (Optional) Process ID. If this argument is included, only information for the specified routing process is included. |

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip ospf** command when entered without a specific OSPF process ID:

```
Router# show ip ospf

Routing Process "ospf 201" with ID 192.42.110.200
Supports only single TOS(TOS0) route
It is an area border and autonomous system boundary router
Summary Link update interval is 0:30:00 and the update due in 0:16:26
External Link update interval is 0:30:00 and the update due in 0:16:27
Redistributing External Routes from,
   igrp 200 with metric mapped to 2, includes subnets in redistribution
   rip with metric mapped to 2
   igrp 2 with metric mapped to 100
   igrp 32 with metric mapped to 1
Number of areas in this router is 3
Area 192.42.110.0
   Number of interfaces in this area is 1
   Area has simple password authentication
   SPF algorithm executed 6 times
   Area ranges are
   Link State Update Interval is 0:30:00 and due in 0:16:55
   Link State Age Interval is 0:20:00 and due in 0:06:55
```

Table 17-19 describes significant fields shown in the display.

**Table 17-19 Show IP OSPF Field Descriptions**

| Field | Description |
|---|---|
| Routing process “ospf 201” with ID 192.42.110.200 | Process ID and OSPF router ID. |
| Type of Service | Number of Types of Service supported (Type 0 only). |
| Type of OSPF Router | Possible types are internal, area border, or autonomous system boundary. |
| Summary Link update interval | Specify summary update interval in hours:minutes:seconds, and time to next update. |
| External Link update interval | Specify external update interval in hours:minutes:seconds, and time to next update. |

| Field | Description |
|---|---|
| Redistributing External Routes from | Lists of redistributed routes, by protocol. |
| Number of areas | Number of areas in router, area addresses, and so on. |
| Link State Update Interval | Specify router and network link state update interval in hours:minutes:seconds, and time to next update. |
| Link State Age Interval | Specify max-aged update deletion interval and time until next database cleanup in hours:minutes:seconds. |

# show ip ospf border-routers

To display the internal OSPF routing table entries to an Area Border Router (ABR) and Autonomous System Boundary Router (ASBR), use the **show ip ospf border-routers** privileged EXEC command.

**show ip ospf borders-routers**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

Privileged EXEC

## Sample Display

The following is sample output from the **show ip ospf border-routers** command:

```
Router# show ip ospf border-routers

OSPF Process 109 internal Routing Table

Destination      Next Hop        Cost   Type     Rte Type Area           SPF No

160.89.97.53     144.144.1.53    10     ABR      INTRA    0.0.0.3        3
160.89.103.51    160.89.96.51    10     ABR      INTRA    0.0.0.3        3
160.89.103.52    160.89.96.51    20     ASBR     INTER    0.0.0.3        3
160.89.103.52    144.144.1.53    22     ASBR     INTER    0.0.0.3        3
```

Table 17-20 describes the fields shown in the display.

**Table 17-20 Show IP OSPF Border-routers Field Descriptions**

| Field | Description |
|---|---|
| Destination | Destination's router ID. |
| Next Hop | Next hop toward the destination. |
| Cost | Cost of using this route. |
| Type | The router type of the destination; it is either an Area Border Router (ABR) or Autonomous System Boundary Router (ASBR) or both. |
| Rte Type | The type of this route, it is either an intra-area or interarea route. |
| Area | The area ID of the area that this route is learned from. |
| SPF No | The internal number of SPF calculation that installs this route. |

# show ip ospf database

To display information about the OSPF database, use the **show ip ospf database** EXEC command.

**show ip ospf** [*process-id area-id*] **database**
**show ip ospf** [*process-id area-id*] **database** [**router**] [*link-state-id*]
**show ip ospf** [*process-id area-id*] **database** [**network**] [*link-state-id*]
**show ip ospf** [*process-id area-id*] **database** [**summary**] [*link-state-id*]
**show ip ospf** [*process-id area-id*] **database** [**asbr-summary**] [*link-state-id*]
**show ip ospf** [*process-id*] **database** [**external**] [*link-state-id*]

## Command Mode

EXEC

## Syntax Description

| | |
|---|---|
| *process-id* | (Optional) Internally used identifier. It is locally assigned and can be any positive integer number. The number used here is the number assigned administratively when enabling the OSPF routing process. |
| *area-id* | (Optional) Area number associated with the OSPF address range. It is defined in the **network** router configuration command used to define the particular area. |
| *link-state-id* | (Optional) Portion of the IP environment that is being described by the advertisement. The value entered depends on the advertisement's LS type. It must be entered in the form of an IP address.<br>When the link state advertisement is describing a network, the *link-state-id* can take one of two forms:<br>—Network's IP address (as in type 3 summary link advertisements and autonomous system external link advertisements).<br>—Derived address obtained from the link state ID. (Note that masking a network links advertisement's link state ID with the network's subnet mask yields the network's IP address.)<br>When the link state advertisement is describing a router, the link state ID is always the described router's OSPF router ID.<br>When an autonomous system external advertisement (LS Type of 5) is describing a default route, its link state ID is set to Default Destination (0.0.0.0). |
| **router** | (Optional) Displays information about router link states. |
| **network** | (Optional) Displays information about network link states. |

| | |
|---|---|
| **summary** | (Optional) Displays summary information about network link states. |
| **asbr-summary** | (Optional) Displays summary information about Autonomous System Boundary Router link states. |
| **external** | (Optional) Displays information about autonomous system external link states. |

## Sample Display Using Show IP OSPF Database with No Optional Arguments or Keywords

The following is sample output from the **show ip ospf database** command when no optional arguments or keywords are used:

```
Router# show ip ospf database

OSPF Router with id(190.20.239.66) (Autonomous system 300)

               Displaying Router Link States(Area 0.0.0.0)

  Link ID       ADV Router         Age        Seq#        Checksum  Link count
155.187.21.6   155.187.21.6    1731    0x80002CFB    0x69BC       8
155.187.21.5   155.187.21.5    1112    0x800009D2    0xA2B8       5
155.187.1.2    155.187.1.2     1662    0x80000A98    0x4CB6       9
155.187.1.1    155.187.1.1     1115    0x800009B6    0x5F2C       1
155.187.1.5    155.187.1.5     1691    0x80002BC     0x2A1A       5
155.187.65.6   155.187.65.6    1395    0x80001947    0xEEE1       4
155.187.241.5  155.187.241.5   1161    0x8000007C    0x7C70       1
155.187.27.6   155.187.27.6    1723    0x80000548    0x8641       4
155.187.70.6   155.187.70.6    1485    0x80000B97    0xEB84       6

               Displaying Net Link States(Area 0.0.0.0)

  Link ID       ADV Router      Age        Seq#        Checksum
155.187.1.3  192.20.239.66     1245    0x800000EC      0x82E

               Displaying Summary Net Link States(Area 0.0.0.0)

  Link ID       ADV Router       Age        Seq#        Checksum
155.187.240.0   155.187.241.5    1152      0x80000077      0x7A05
155.187.241.0   155.187.241.5    1152      0x80000070      0xAEB7
155.187.244.0   155.187.241.5    1152      0x80000071      0x95CB
```

Table 17-21 describes the fields shown in the display.

**Table 17-21 Show IP OSPF Database Field Descriptions**

| Field | Description |
|---|---|
| Link ID | Router ID number. |
| ADV Router | Advertising router's router ID. |
| Age | Link state age. |

| Field | Description |
|---|---|
| Seq# | Link state sequence number (detects old or duplicate link state advertisements). |
| Checksum | Fletcher checksum of the complete contents of the link state advertisement. |
| Link count | Number of interfaces detected for router. |

## Sample Display Using Show IP OSPF Database ASBR-Summary

The following is sample output from the **show ip ospf database asbr-summary** command:

```
Router# show ip ospf database asbr-summary

OSPF Router with id(190.20.239.66) (Autonomous system 300)

                Displaying Summary ASB Link States(Area 0.0.0.0)

LS age: 1463
Options: (No TOS-capability)
LS Type: Summary Links(AS Boundary Router)
Link State ID: 155.187.245.1 (AS Boundary Router address)
Advertising Router: 155.187.241.5
LS Seq Number: 80000072
Checksum: 0x3548
Length: 28
Network Mask: 0.0.0.0 TOS: 0  Metric: 1
```

Table 17-22 describes the fields shown in the display.

**Table 17-22 Show IP OSPF Database ASB-Summary Field Descriptions**

| Field | Description |
|---|---|
| Router ID | Router ID number. |
| Autonomous system | OSPF autonomous system number (OSPF process ID). |
| LS age | Link state age. |
| Options | Type of Service options (Type 0 only). |
| LS Type | Link state type. |
| Link State ID | Link state ID (autonomous system boundary router)**.** |
| Advertising Router | Advertising router's router ID. |
| LS Seq Number | Link state sequence (detects old or duplicate link state advertisements). |
| Checksum | LS checksum (Fletcher checksum of the complete contents of the link state advertisement). |
| Length | Length in bytes of the link state advertisement. |
| Network Mask | Network mask implemented. |
| TOS | Type of Service. |
| Metric | Link state metric. |

### Sample Display Using Show IP OSPF Database External

The following is sample output from the **show ip ospf database external** command:

```
Router# show ip ospf database external

OSPF Router with id(190.20.239.66) (Autonomous system 300)

                Displaying AS External Link States

LS age: 280
Options: (No TOS-capability)
LS Type: AS External Link
Link State ID: 143.105.0.0 (External Network Number)
Advertising Router: 155.187.70.6
LS Seq Number: 80000AFD
Checksum: 0xC3A
Length: 36
Network Mask: 255.255.0.0
     Metric Type: 2 (Larger than any link state path)
     TOS: 0
     Metric: 1
     Forward Address: 0.0.0.0
     External Route Tag: 0
```

Table 17-23 describes the fields shown in the display.

**Table 17-23 Show IP OSPF Database External Field Descriptions**

| Field | Description |
|---|---|
| Router ID | Router ID number. |
| Autonomous system | OSPF autonomous system number (OSPF process ID). |
| LS age | Link state age. |
| Options | Type of Service options (Type 0 only). |
| LS Type | Link state type. |
| Link State ID | Link state ID (External Network Number). |
| Advertising Router | Advertising router's router ID. |
| LS Seq Number | Link state sequence number (detects old or duplicate link state advertisements). |
| Checksum | LS checksum (Fletcher checksum of the complete contents of the link state advertisement). |
| Length | Length in bytes of the link state advertisement. |
| Network Mask | Network mask implemented. |
| Metric Type | External Type. |
| TOS | Type of Service. |
| Metric | Link state metric. |
| Forward Address | Forwarding address. Data traffic for the advertised destination will be forwarded to this address. If the forwarding address is set to 0.0.0.0, data traffic will be forwarded instead to the advertisement's originator. |
| External Route Tag | External route tag, a 32-bit field attached to each external route. This is not used by the OSPF protocol itself. |

### Sample Display Using Show IP OSPF Database Network

The following is sample output from the **show ip ospf database network** command:

```
Router# show ip ospf database network
 OSPF Router with id(190.20.239.66) (Autonomous system 300)

                Displaying Net Link States(Area 0.0.0.0)

LS age: 1367
Options: (No TOS-capability)
LS Type: Network Links
Link State ID: 155.187.1.3 (address of Designated Router)
Advertising Router: 190.20.239.66
LS Seq Number: 800000E7
Checksum: 0x1229
Length: 52
Network Mask: 255.255.255.0
        Attached Router: 190.20.239.66
        Attached Router: 155.187.241.5
        Attached Router: 155.187.1.1
        Attached Router: 155.187.54.5
        Attached Router: 155.187.1.5
```

Table 17-24 describes the fields shown in the display.

**Table 17-24 Show IP OSPF Database Network Field Descriptions**

| Field | Description |
|---|---|
| OSPF Router with ID(190.20.239.66) | Router ID number. |
| Autonomous system 300 | OSPF autonomous system number (OSPF process ID). |
| LS age: 1367 | Link state age. |
| Options: (No TOS-capability) | Type of Service options (Type 0 only). |
| LS Type: Network Links | Link state type. |
| Link State ID | Link state ID of designated router. |
| Advertising Router | Advertising router's router ID. |
| LS Seq Number | Link state sequence (detects old or duplicate link state advertisements). |
| Checksum | LS checksum (Fletcher checksum of the complete contents of the link state advertisement). |
| Network Mask | Network mask implemented. |
| AS Boundary Router | Definition of router type. |
| Other fields | List of routers attached to the network, by IP address. |

### Sample Display Using Show IP OSPF Database Router

The following is sample output from the **show ip ospf database router** command:

```
Router# show ip ospf database router

OSPF Router with id(190.20.239.66) (Autonomous system 300)

                Displaying Router Link States(Area 0.0.0.0)

LS age: 1176
Options: (No TOS-capability)
LS Type: Router Links
Link State ID: 155.187.21.6
Advertising Router: 155.187.21.6
LS Seq Number: 80002CF6
Checksum: 0x73B7
Length: 120
AS Boundary Router
155   Number of Links: 8

Link connected to: another Router (point-to-point)
(link ID) Neighboring Router ID: 155.187.21.5
(Link Data) Router Interface address: 155.187.21.6
Number of TOS metrics: 0
TOS 0 Metrics: 2
```

Table 17-25 describes the fields shown in the display.

**Table 17-25 Show IP OSPF Database Router Field Descriptions**

| Field | Description |
|---|---|
| Router ID | Router ID number. |
| Autonomous system | OSPF autonomous system number (OSPF process ID). |
| LS age | Link state age. |
| Options | Type of Service options (Type 0 only). |
| LS Type | Link state type. |
| Link State ID | Link state ID. |
| Advertising Router | Advertising router's router ID. |
| LS Seq Number | Link state sequence (detects old or duplicate link state advertisements). |
| Checksum | LS checksum (Fletcher checksum of the complete contents of the link state advertisement). |
| Length | Length in bytes of the link state advertisement. |
| AS Boundary Router | Definition of router type. |
| Number of Links | Number of active links. |
| link ID | Link type. |
| Link Data | Router interface address. |
| TOS | Type of Service metric (Type 0 only). |

### Sample Display Using Show IP OSPF Database Summary

The following is sample output from **show ip ospf database summary** command:

```
Router# show ip ospf database summary

       OSPF Router with id(190.20.239.66) (Autonomous system 300)

                Displaying Summary Net Link States(Area 0.0.0.0)

LS age: 1401
Options: (No TOS-capability)
LS Type: Summary Links(Network)
Link State ID: 155.187.240.0 (summary Network Number)
Advertising Router: 155.187.241.5
LS Seq Number: 80000072
Checksum: 0x84FF
Length: 28
Network Mask: 255.255.255.0   TOS: 0  Metric: 1
```

Table 17-26 describes the fields shown in the display.

**Table 17-26 Show IP OSPF Database Summary Field Descriptions**

| Field | Description |
|---|---|
| Router ID | Router ID number. |
| Autonomous system | OSPF autonomous system number (OSPF process ID). |
| LS age | Link state age. |
| Options | Type of Service options (Type 0 only). |
| LS Type | Link state type. |
| Link State ID | Link state ID (summary network number)**.** |
| Advertising Router | Advertising router's router ID. |
| LS Seq Number | Link state sequence (detects old or duplicate link state advertisements). |
| Checksum | LS checksum (Fletcher checksum of the complete contents of the link state advertisement). |
| Length | Length in bytes of the link state advertisement. |
| Network Mask | Network mask implemented. |
| TOS | Type of Service. |
| Metric | Link state metric. |

# show ip ospf interface

To display OSPF-related interface information, use the **show ip ospf interface** EXEC command.

**show ip ospf interface** [*type number*]

## Syntax Description

| | |
|---|---|
| *type* | (Optional) Interface type |
| *number* | (Optional) Interface number |

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip ospf interface** command when Ethernet 0 is specified:

```
Router# show ip ospf interface ethernet 0

Ethernet 0 is up, line protocol is up
Internet Address 131.119.254.202, Mask 255.255.255.0, Area 0.0.0.0
AS 201, Router ID 192.77.99.1, Network Type BROADCAST, Cost: 10
Transmit Delay is 1 sec, State OTHER, Priority 1
Designated Router id 131.119.254.10, Interface address 131.119.254.10
Backup Designated router id 131.119.254.28, Interface addr 131.119.254.28
Timer intervals configured, Hello 10, Dead 60, Wait 40, Retransmit 5
Hello due in 0:00:05
Neighbor Count is 8, Adjacent neighbor count is 2
  Adjacent with neighbor 131.119.254.28  (Backup Designated Router)
  Adjacent with neighbor 131.119.254.10  (Designated Router)
```

Table 17-27 describes significant fields shown in the display.

**Table 17-27 Show IP OSPF Interface Ethernet 0 Field Descriptions**

| Field | Description |
|---|---|
| Ethernet | Status of physical link and operational status of protocol. |
| Internet Address | Interface IP address, subnet mask, and area address. |
| AS | Autonomous system number (OSPF process ID), router ID, network type, link state cost. |
| Transmit Delay | Transmit delay, interface state, and router priority. |
| Designated Router | Designated router ID and respective interface IP address. |
| Backup Designated router | Backup designated router ID and respective interface IP address. |
| Timer intervals configured | Configuration of timer intervals. |
| Hello | Number of seconds until next Hello packet is sent out this interface. |
| Neighbor Count | Count of network neighbors and list of adjacent neighbors. |

# show ip ospf neighbor

To display OSPF-neighbor information on a per-interface basis, use the **show ip ospf neighbor** EXEC command.

**show ip ospf neighbor** [*interface*] [*neighbor-id*] **detail**

## Syntax Description

| | |
|---|---|
| *interface* | (Optional) Interface type and number. |
| *neighbor-id* | (Optional) Neighbor ID. |
| **detail** | Display all neighbors given in detail (list all neighbors). |

## Command Mode

EXEC

## Sample Displays

The following is sample output from the **show ip ospf neighbor** command showing a single line of summary information for each neighbor:

```
Router# show ip ospf neighbor

   ID           Pri   State         Dead Time     Address         Interface
199.199.199.137 1    FULL/DR        0:00:31    160.89.80.37      Ethernet0
192.31.48.1     1    FULL/DROTHER   0:00:33    192.31.48.1       Fddi0
192.31.48.200   1    FULL/DROTHER   0:00:33    192.31.48.200     Fddi0
199.199.199.137 5    FULL/DR        0:00:33    192.31.48.189     Fddi0
```

The following is sample output showing summary information about the neighbor that matches the neighbor ID:

```
Router# show ip ospf neighbor 199.199.199.137
 Neighbor 199.199.199.137, interface address 160.89.80.37
    In the area 0.0.0.0 via interface Ethernet0
    Neighbor priority is 1, State is FULL
    Options 2
    Dead timer due in 0:00:32
    Link State retransmission due in 0:00:04
 Neighbor 199.199.199.137, interface address 192.31.48.189
    In the area 0.0.0.0 via interface Fddi0
    Neighbor priority is 5, State is FULL
    Options 2
    Dead timer due in 0:00:32
    Link State retransmission due in 0:00:03
```

If you specify the interface along with the Neighbor ID, the router displays the neighbors that match the neighbor ID on the interface, as in the following sample display:

```
Router# show ip ospf neighbor e 0 199.199.199.137
 Neighbor 199.199.199.137, interface address 160.89.80.37
    In the area 0.0.0.0 via interface Ethernet0
    Neighbor priority is 1, State is FULL
    Options 2
    Dead timer due in 0:00:37
    Link State retransmission due in 0:00:04
```

You can also specify the interface without the neighbor ID to show all neighbors on the specified interface, as in the following sample display:

```
Router# show ip ospf neighbor f 0

   ID           Pri   State        Dead Time     Address         Interface
192.31.48.1      1    FULL/DROTHER  0:00:33    192.31.48.1       Fddi0
192.31.48.200    1    FULL/DROTHER  0:00:32    192.31.48.200     Fddi0
199.199.199.137 5     FULL/DR       0:00:32    192.31.48.189     Fddi0
```

The following is sample output from the **show ip ospf neighbor detail** command:

```
Router# show ip ospf neighbor detail
 Neighbor 160.89.96.54, interface address 160.89.96.54
    In the area 0.0.0.3 via interface Ethernet0
    Neighbor priority is 1, State is FULL
    Options 2
    Dead timer due in 0:00:38
 Neighbor 160.89.103.52, interface address 160.89.103.52
    In the area 0.0.0.0 via interface Serial0
    Neighbor priority is 1, State is FULL
    Options 2
    Dead timer due in 0:00:31
```

Table 17-28 describes the fields shown in the displays.

**Table 17-28 Show IP OSPF Neighbor Field Descriptions**

| Field | Description |
|---|---|
| Neighbor x.x.x.x | Neighbor router ID. |
| interface address x.x.x.x | IP address of the interface. |
| In the area | Area and interface through which OSPF neighbor is known. |
| Neighbor priority | Router priority of neighbor, neighbor state. |
| State | OSPF state. |
| Options | Hello packet options field contents (E-bit only; possible values are 0 and 2; 2 indicates area is not a stub; 0 indicates area is a stub. |
| Dead timer | Expected time before router will declare neighbor dead. |

# show ip ospf virtual-links

To display parameters about and the current state of OSPF virtual links, use the **show ip ospf virtual-links** EXEC command.

**show ip ospf virtual-links**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

EXEC

## Usage Guidelines

The information displayed by **show ip ospf virtual-links** is useful in debugging OSPF routing operations.

## Sample Display

The following is sample output from the **show ip ospf virtual-links** command:

```
Router# show ip ospf virtual-links

Virtual Link to router 160.89.101.2 is up
Transit area 0.0.0.1, via interface Ethernet0, Cost of using 10
Transmit Delay is 1 sec, State POINT_TO_POINT
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 0:00:08
Adjacency State FULL
```

Table 17-29 describes significant fields shown in the display.

**Table 17-29 Show IP OSPF Virtual-links Field Descriptions**

| Field | Description |
|---|---|
| Virtual Link to router 160.89.101.2 is Up | Specifies the OSPF neighbor, and if the link to that neighbor is Up or Down. |
| Transit area 0.0.0.1 | The transit area through which the virtual link is formed. |
| via interface Ethernet0 | The interface through which the virtual link is formed. |
| Cost of using 10 | The cost of reaching the OSPF neighbor through the virtual link. |
| Transmit Delay is 1 sec | The transmit delay on the virtual link. |
| State POINT_TO_POINT | The state of the OSPF neighbor. |
| Timer intervals... | The various timer intervals configured for the link. |
| Hello due in 0:00:08 | When the next Hello is expected from the neighbor. |
| Adjacency State FULL | The adjacency state between the neighbors. |

# show ip pim interface

To display information about interfaces configured for PIM, use the **show ip pim interface** EXEC command.

**show ip pim interface** [*interface*]

## Syntax Description

| | |
|---|---|
| *interface* | (Optional) Interface type and number |

## Command Mode

EXEC

## Usage Guidelines

This command works only on interfaces that are configured for PIM.

## Sample Display

The following is sample output from the **show ip pim interface** command:

```
Router# show ip pim interface
Address          Interface          Mode    Neighbor  Query     DR
                                            Count     Interval
198.92.37.6      Ethernet0          Dense   2         30        198.92.37.33
198.92.36.129    Ethernet1          Dense   2         30        198.92.36.131
10.1.37.2        Tunnel0            Dense   1         30        0.0.0.0
```

Table 17-30 describes the fields shown in the display.

**Table 17-30 Show IP PIM Interface Field Description**

| Field | Description |
|---|---|
| Address | IP address of the next-hop router. |
| Interface | Interface type and number that is configured to run PIM. |
| Mode | Multicast mode in which the router is operating. This can be dense mode or sparse mode. |
| Neighbor Count | Number of PIM neighbors that have been discovered through this interface. |
| Query Interval | Frequency, in seconds, of PIM router-query messages, as set by the **ip pim query-interval** interface configuration command. The default is 30 seconds. |
| DR | IP address of the designated router on the LAN. Note that serial lines do not have designated routers, so the IP address is shown as 0.0.0.0. |

## Related Commands

**ip pim**
**show ip pim neighbor**

# show ip pim neighbor

To list the PIM neighbors discovered by the router, use the **show ip pim neighbor** EXEC command.

**show ip pim neighbor** [*interface*]

## Syntax Description

| | |
|---|---|
| *interface* | (Optional) Interface type and number |

## Command Mode

EXEC

## Usage Guidelines

Use this command to determine which routers on the LAN are configured for PIM.

## Sample Display

The following is sample output from the **show ip pim neighbor** command:

```
Router# show ip pim neighbor
PIM Neighbor Table
Neighbor Address  Interface          Uptime    Expires   Mode
198.92.37.2       Ethernet0          17:38:16  0:01:25   Dense
198.92.37.33      Ethernet0          17:33:20  0:01:05   Dense (DR)
198.92.36.131     Ethernet1          17:33:20  0:01:08   Dense (DR)
198.92.36.130     Ethernet1          18:56:06  0:01:04   Dense
10.1.22.9         Tunnel0            19:14:59  0:01:09   Dense
```

Table 17-31 describes the fields shown in the display.

**Table 17-31 Show IP PIM Neighbor Field Description**

| Field | Description |
|---|---|
| Neighbor Address | IP address of the PIM neighbor. |
| Interface | Interface type and number on which the neighbor is reachable. |
| Uptime | How long in hours, minutes, and seconds the entry has been in the PIM neighbor table. |
| Expires | How long in hours, minutes, and seconds until the entry will be removed from the IP multicast routing table. |
| Mode | Mode in which the interface is operating. |
| (DR) | Indicates that this neighbor is a designated router on the LAN. |

## Related Command

**show ip pim interface**

# show ip pim rp

To display the rendezvous point (RP) routers associated with a sparse-mode multicast group, use the **show ip pim rp** EXEC command.

**show ip pim rp** [*group-name* | *group-address*]

## Syntax Description

| | |
|---|---|
| *group-name* | (Optional) Name of the multicast group, as defined in the DNS hosts table. |
| *group-address* | (Optional) Address of the multicast group. This is a multicast IP address in four-part dotted notation. |

## Command Mode

EXEC

## Sample Displays

The following is sample output from the **show ip pim rp** command from a router that is not an RP:

```
Router1# show ip pim rp
Group: 224.2.127.255, number of RPs: 1
  RP address: 198.92.37.2, state: Up, uptime 0:01:25, expires in 0:03:04
```

The following is sample output from the **show ip pim rp** command from a router that is an RP:

```
Router2# show ip pim rp
Group: 224.2.127.255, number of RPs: 1
  RP address: 198.92.37.2, state: Up, next RP-reachable in 0:01:01
```

Table 17-32 explains the fields shown in the displays.

**Table 17-32 Show IP PIM RP Field Description**

| Field | Description |
|---|---|
| Group: | Address of the multicast group. |
| number of RPs: | Number of RPs in the multicast group. |
| RP address: | Address of the RP. |
| state: | State of the RP router. It can be Up or Down. |
| uptime | How long in hours, minutes, and seconds the RP has been up. |
| expires | How long in hours, minutes, and seconds until the entry for this RP expires. |
| next RP-reachable in | How long in hours, minutes, and seconds until the RP will send its next RP-reachable message. |

## Related Command

**show ip mroute**

# show ip protocols

To display the parameters and current state of the active routing protocol process, use the **show ip protocols** EXEC command.

**show ip protocols**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

EXEC

## Usage Guidelines

The information displayed by **show ip protocols** is useful in debugging routing operations. Information in the Routing Information Sources field of the **show ip protocols** output can help you identify a router suspected of delivering bad routing information.

## Sample Displays

The following is sample output from the **show ip protocols** command, showing IGRP processes:

```
Router# show ip protocols
Routing Protocol is "igrp 109"
  Sending updates every 90 seconds, next due in 44 seconds
  Invalid after 270 seconds, hold down 280, flushed after 630
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  IGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  IGRP maximum hopcount 100
  IGRP maximum metric variance 1
  Redistributing: igrp 109
  Routing for Networks:
    198.92.72.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    198.92.72.18         100      0:56:41
    198.92.72.19         100      6d19
    198.92.72.22         100      0:55:41
    198.92.72.20         100      0:01:04
    198.92.72.30         100      0:01:29
  Distance: (default is 100)

Routing Protocol is "bgp 1878"
  Sending updates every 60 seconds, next due in 0 seconds
  Outgoing update filter list for all interfaces is 1
  Incoming update filter list for all interfaces is not set
  Redistributing: igrp 109
  IGP synchronization is disabled
  Automatic route summarization is enabled
  Neighbor(s):
    Address          FiltIn FiltOut DistIn DistOut Weight RouteMap
    192.108.211.17                1
    192.108.213.89                1
    198.6.255.13                  1
```

```
  198.92.72.18                  1
  198.92.72.19
  198.92.84.17                  1
Routing for Networks:
  192.108.209.0
  192.108.211.0
  198.6.254.0
Routing Information Sources:
  Gateway         Distance      Last Update
  198.92.72.19          20      0:05:28
Distance: external 20 internal 200 local 200
```

Table 17-33 describes significant fields shown in the display.

**Table 17-33 Show IP Protocols Field Descriptions**

| Field | Description |
|---|---|
| Routing Protocol is “igrp 109” | Specifies the routing protocol used. |
| Sending updates every 90 seconds | Specifies the time between sending updates. |
| next due in 88 seconds | Precisely when the next update is due to be sent. |
| Invalid after 270 seconds | Specifies the value of the invalid parameter. |
| hold down for 280 | Specifies the current value of the hold-down parameter. |
| flushed after 630 | Specifies the time in seconds after which the individual routing information will be thrown (flushed) out. |
| Outgoing update ... | Specifies whether the outgoing filtering list has been set. |
| Incoming update ... | Specifies whether the incoming filtering list has been set. |
| Default networks | Specifies how these networks will be handled in both incoming and outgoing updates. |
| IGRP metric | Specifies the value of the K0-K5 metrics as well as the maximum hopcount. |
| Redistributing | Lists the protocol that is being redistributed. |
| Routing | Specifies the networks that the routing process is currently injecting routes for. |
| Routing Information Sources | Lists all the routing sources the router is using to build its routing table. For each source, you will see displayed:<br>• IP address<br>• Administrative distance<br>• Time the last update was received from this source. |

The following is sample output from the **show ip protocols** command, showing Enhanced IGRP processes:

```
Router# show ip protocols
Routing Protocol is "eigrp 77"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: eigrp 77
  Automatic network summarization is in effect
  Routing for Networks:
    160.89.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    160.89.81.28          90      0:02:36
    160.89.80.28          90      0:03:04
    160.89.80.31          90      0:03:04
  Distance: internal 90 external 170
```

Table 17-34 describes the fields that might be shown in the display.

**Table 17-34 Show IP Protocols Field Descriptions**

| Field | Description |
|---|---|
| Routing Protocol is “eigrp 77” | Name and autonomous system number of the currently running routing protocol. |
| Outgoing update filter list for all interfaces... | Indicates whether a filter for outgoing routing updates has been specified with the **distribute-list out** command. |
| Outgoing update filter list for all interfaces... | Indicates whether a filter for outgoing routing updates has been specified with the **distribute-list in** command. |
| Redistributing: eigrp 77 | Indicates whether route redistribution has been enabled with the **redistribute** command. |
| Automatic network summarization... | Indicates whether route summarization has been enabled with the **auto-summary** command. |
| Routing for Networks: | Networks that the routing process is currently injecting routes for. |
| Routing Information Sources: | Lists all the routing sources that the router is using to build its routing table. The following is displayed for each source: IP address, administrative distance, and time the last update was received from this source. |
| Distance: internal 90 external 170 | Internal and external distances of the router. Internal distance is the degree of preference given to Enhanced IGRP internal routes. External distance is the degree of preference given to Enhanced IGRP external routes. |

The following is sample output from the **show ip protocols** command, showing IS-IS processes:

```
Router# show ip protocols
Routing Protocol is "isis"
  Sending updates every 0 seconds
  Invalid after 0 seconds, hold down 0, flushed after 0
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: isis
  Address Summarization:
    None
  Routing for Networks:
    Serial0
  Routing Information Sources:
  Distance: (default is 115)
```

# show ip route

To display the current state of the routing table, use the **show ip route** EXEC command.

**show ip route** [*ip-address* [*mask*] | *protocol* [*process-id*]]

## Syntax Description

| | |
|---|---|
| *ip-address* | (Optional) Address about which to display routing information |
| *mask* | (Optional) Subnet mask of the subnet about which to display routing information |
| *protocol* | (Optional) Name of a routing protocol; or the keyword **connected**, **static**, or **summary**. If you specify a routing protocol, use one of the following keywords: **bgp**, **egp**, **eigrp**, **hello**, **igrp**, **isis**, **ospf**, or **rip**. |
| *process-id* | (Optional) Identifier of the particular routing protocol process |

## Command Mode

EXEC

## Sample Displays

The following is sample output from the **show ip route** command when entered when you do not specify an address:

```
Router# show ip route

Codes: I - IGRP derived, R - RIP derived, O - OSPF derived
       C - connected, S - static, E - EGP derived, B - BGP derived
       * - candidate default route, IA - OSPF inter area route
       E1 - OSPF external type 1 route, E2 - OSPF external type 2 route

Gateway of last resort is 131.119.254.240 to network 129.140.0.0

O E2 150.150.0.0 [160/5] via 131.119.254.6, 0:01:00, Ethernet2
E    192.67.131.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet2
O E2 192.68.132.0 [160/5] via 131.119.254.6, 0:00:59, Ethernet2
O E2 130.130.0.0 [160/5] via 131.119.254.6, 0:00:59, Ethernet2
E    128.128.0.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet2
E    129.129.0.0 [200/129] via 131.119.254.240, 0:02:22, Ethernet2
E    192.65.129.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet2
E    131.131.0.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet2
E    192.75.139.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet2
E    192.16.208.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet2
E    192.84.148.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet2
E    192.31.223.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet2
E    192.44.236.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet2
E    140.141.0.0 [200/129] via 131.119.254.240, 0:02:22, Ethernet2
E    141.140.0.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet2
```

The following is sample output that includes some IS-IS Level 2 routes learned:

```
Router# show ip route
Codes: I - IGRP derived, R - RIP derived, O - OSPF derived
       C - connected, S - static, E - EGP derived, B - BGP derived
       i - IS-IS derived
       * - candidate default route, IA - OSPF inter area route
E1 - OSPF external type 1 route, E2 - OSPF external type 2 route
       L1 - IS-IS level-1 route, L2 - IS-IS level-2 route

Gateway of last resort is not set

     160.89.0.0 is subnetted (mask is 255.255.255.0), 3 subnets
C       160.89.64.0 255.255.255.0 is possibly down,
          routing via 0.0.0.0, Ethernet0
i L2    160.89.67.0 [115/20] via 160.89.64.240, 0:00:12, Ethernet0
i L2    160.89.66.0 [115/20] via 160.89.64.240, 0:00:12, Ethernet0
```

Table 17-35 describes the fields shown in the displays.

**Table 17-35 Show IP Route Field Descriptions**

| Field | Description |
|---|---|
| Codes | Codes defining how the route was learned and the type of route. |
| I | Route learned via IGRP. |
| R | Route learned from a RIP update. |
| O | Route learned from an OSPF update. |
| C | Directly connected network. |
| S | Statically defined route via the **ip route** command. |
| E | Route learned from EGP. |
| B | Route learned from BGP. |
| i | Router learned from IS-IS. |
| D | Route leaved via Enhanced IGRP. |
| * | Candidate default route. In the list of routes, the asterisk is the robin pointer. It indicates the last path used when a packet was forwarded. It applies only to non-fast-switched packets. The asterisk does not give an indication of which path will be used next when forwarding a non-fast-switched packet except when the paths are equal-cost paths. Paths can be equal cost only when runnign RIP. |
| IA | OSPF interarea route. |
| E1 | OSPF external type 1 route. |
| E2 | OSPF external type 2 route. |
| L1 | IS-IS Level 1 route. |
| L2 | IS-IS Level 2 route. |
| EX | External enhanced IGRP route. |
| 150.150.0.0 | Indicates the address of the remote network. |
| [160/5] | The first number in the brackets is the administrative distance of the information source; the second number is the metric for the route. |
| via 131.119.254.6 | Specifies the address of the next router to the remote network. |

| Field | Description |
|---|---|
| 0:01:00 | Specifies the last time the route was updated in hours:minutes:seconds. |
| Ethernet 2 | Specifies the interface through which the specified network can be reached. |
| * | Indicates the last path used when a packet was forwarded. It pertains only to the nonfast-switched packets. However, it does not indicate what path will be used next when forwarding a nonfast-switched packet except when the paths are equal cost. |

When you specify that you want information about a specific network displayed, more detailed statistics are shown. The following is sample output from the **show ip route** command when entered with the address 131.119.0.0.

```
Router# show ip route 131.119.0.0

Routing entry for 131.119.0.0 (mask 255.255.0.0)
   Known via "igrp 109", distance 100, metric 10989
   Tag 0
   Redistributing via igrp 109
   Last update from 131.108.35.13 on TokenRing0, 0:00:58 ago
   Routing Descriptor Blocks:
   * 131.108.35.13, from 131.108.35.13, 0:00:58 ago, via TokenRing0
      Route metric is 10989, traffic share count is 1
      Total delay is 45130 microseconds, minimum bandwidth is 1544 Kbit
      Reliability 255/255, minimum MTU 1500 bytes
      Loading 2/255, Hops 4
```

Table 17-36 describes the fields shown in the display.

**Table 17-36 Show IP Route Field Descriptions**

| Field | Description |
|---|---|
| Routing entry for 131.119.0.0 (mask 255.255.0.0) | Network number and mask. |
| Known via “igrp 109” | Indicates how the route was derived. |
| distance 100 | Administrative distance of the information source. |
| Tag 0 | Integer that is used to implement the route. |
| Redistributing via igrp 109 | Indicates redistribution protocol. |
| Last update from 131.108.35.13 on TokenRing0 | Indicates the IP address of a router that is the next hop to the remote network and the router interface on which the last update arrived. |
| 0:00:58 ago | Specifies the last time the route was updated in hours:minutes:seconds. |
| 131.108.35.13, from 131.108.35.13, 0:00:58 ago | Indicates the next hop address, the address of the gateway that sent the update, and the time that has elapsed since this update was received in hours:minutes:seconds. |
| via TokenRing0 | Interface for this route. |
| Route metric is 10989 | This value is the best metric for this routing descriptor block. |
| traffic share count is 1 | Number of uses for this routing descriptor block. |
| Total delay is 45130 microseconds | Total propagation delay in microseconds. |

| Field | Description |
|---|---|
| minimum bandwidth is 1544 Kbit | Minimum bandwidth encountered when transmitting data along this route. |
| Reliability 255/255 | Likelihood of successful packet transmission expressed as a number between 0 and 255 (255 is 100% reliability). |
| minimum MTU 1500 bytes | Smallest MTU along the path. |
| Loading 2/255 | Effective bandwidth of the route in kilobits per second/255 is saturation. |
| Hops 4 | Hops to the destination or to the router where the route first enters IGRP. |

## Related Commands

A dagger (†) indicates that the command is documented in another chapter.

**show interfaces tunnel** †
**show ip route summary**

# show ip route summary

To display the current state of the routing table, use the **show ip route summary** EXEC command.

**show ip route summary**

## Syntax Description

This command has no arguments or keywords.

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show ip route summary** command:

```
Router# show ip route summary
Route Source    Networks    Subnets     Overhead    Memory (bytes)
connected       0           3           126         360
static          1           2           126         360
igrp 109        747         12          31878       91080
internal        3                                   360
Total           751         17          32130       92160
Router#
```

Table 17-37 describes the fields shown in the display:

**Table 17-37 Show IP Route Summary Field Descriptions**

| Field | Description |
|---|---|
| Route Source | Routing protocol name, or the keyword **connected**, **static** or **internal**. Internal indicates those routes that are in the routing table that are not owned by any routing protocol. |
| Networks | Number of Class A, B, or C networks that are present in the routing table for each route source. |
| Subnets | Number of subnets that are present in the routing table for each route source, including host routes. |
| Overhead | Any additional memory involved in allocating the routes for the particular route source other than the memory specified in the Memory field. |
| Memory | Number of bytes allocated to maintain all the routes for the particular route source. |

## Related Command

**show ip route**

# show ip route supernets-only

To display information about supernets, use the **show ip route supernets-only** privileged EXEC command.

**show ip route supernets-only**

## Command Mode

Privileged EXEC

## Sample Display

The following is sample output from the **show ip route supernets-only** command:

```
Router# show ip route supernets-only
Codes: I - IGRP derived, R - RIP derived, O - OSPF derived
       C - connected, S - static, E - EGP derived, B - BGP derived
       i - IS-IS derived, D - EIGRP derived
       * - candidate default route, IA - OSPF inter area route
       E1 - OSPF external type 1 route, E2 - OSPF external type 2 route
       L1 - IS-IS level-1 route, L2 - IS-IS level-2 route
       EX - EIGRP external route

Gateway of last resort is not set

B    198.92.0.0 (mask is 255.255.0.0) [20/0] via 198.92.72.30, 0:00:50
B    192.0.0.0 (mask is 255.0.0.0) [20/0] via 198.92.72.24, 0:02:50
Router#
```

This display shows supernets only; it does not show subnets.

# show isis database

To display the IS-IS link state database, use the **show isis database** EXEC command.

**show isis database** [**level-1**] [**level-2**] [**l1**] [**l2**] [**detail**] [**lspid**]

### Syntax Description

| | |
|---|---|
| **level-1** | (Optional) Displays the IS-IS link state database for Level 1. |
| **level-2** | (Optional) Displays the IS-IS link state database for Level 2. |
| **l1** | (Optional) Abbreviation for the option **level-1**. |
| **l2** | (Optional) Abbreviation for the option **level-2**. |
| **detail** | (Optional) When specified, the contents of each LSP is displayed. Otherwise, a summary display is provided. |
| **lspid** | (Optional) Link-state protocol ID. When specified, the contents of a single LSP is displayed by its ID number. |

### Command Mode

EXEC

### Usage Guidelines

Each of the options shown in brackets for this command can be entered in an arbitrary string within the same command entry. For example, the following are both valid command specifications and provide the same output: **show isis database detail l2** and **show isis database l2 detail**.

### Sample Display

The following is sample output from the **show isis database** command when it is specified with no options or as **show isis database l1 l2**:

```
Router# show isis database

IS-IS Level-1 Link State Database
LSPID                 LSP Seq Num    LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.00-00  0x0000000C     0x5696        792           0/0/0
0000.0C00.40AF.00-00* 0x00000009     0x8452        1077          1/0/0
0000.0C00.62E6.00-00  0x0000000A     0x38E7        383           0/0/0
0000.0C00.62E6.03-00  0x00000006     0x82BC        384           0/0/0
0800.2B16.24EA.00-00  0x00001D9F     0x8864        1188          1/0/0
0800.2B16.24EA.01-00  0x00001E36     0x0935        1198          1/0/0

IS-IS Level-2 Link State Database
LSPID                 LSP Seq Num    LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.03-00  0x00000005     0x04C8        792           0/0/0
0000.0C00.3E51.00-00  0x00000007     0xAF96        758           0/0/0
0000.0C00.40AF.00-00* 0x0000000A     0x3AA9        1077          0/0/0
```

Table 17-38 describes significant fields shown in the display.

**Table 17-38 Show IS-IS Database Field Descriptions**

| Field | Description |
|---|---|
| LSPID | The link state PDU ID. The first six octets form the System ID. The next octet is the pseudo ID. When this value is zero, the LSP describes links from the system. When it is nonzero, the LSP is a pseudonode LSP. The designated router for an interface is the only system that originates pseudonode LSPs. The last octet is the LSP number. If there is more data than can fit in a single LSP, additional LSPs are sent with increasing LSP numbers. An asterisk (*) indicates that the LSP was originated by the local system. |
| LSP Seq Num | Sequence number for the LSP that allows other systems to determine if they have received the latest information from the source. |
| LSP Checksum | Checksum of the entire LSP packet. |
| LSP Holdtime | Amount of time the LSP remains valid, in seconds. |
| ATT | The attach bit. This indicates that the router is also a Level 2 router, and it can reach other areas. |
| P | The P bit. Detects if the IS is area partition repair capable. |
| OL | The Overload bit. Determines if the IS is congested. |

## Sample Display Using Show IS-IS Database Detail

The following is sample output from the **show isis database detail** command.

```
Router# show isis database detail

IS-IS Level-1 Link State Database
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.00-00  0x0000000C   0x5696        325           0/0/0
  Area Address: 47.0004.004D.0001
  Area Address: 39.0001
  Metric: 10   IS 0000.0C00.62E6.03
  Metric: 0    ES 0000.0C00.0C35
 --More--
0000.0C00.40AF.00-00* 0x00000009   0x8452        608           1/0/0
  Area Address: 47.0004.004D.0001
  Metric: 10   IS 0800.2B16.24EA.01
  Metric: 10   IS 0000.0C00.62E6.03
  Metric: 0    ES 0000.0C00.40AF

IS-IS Level-2 Link State Database
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.0C35.03-00  0x00000005   0x04C8        317           0/0/0
  Metric: 0    IS 0000.0C00.0C35.00
 --More--
0000.0C00.3E51.00-00  0x00000009   0xAB98        1182          0/0/0
  Area Address: 39.0004
  Metric: 10   IS 0000.0C00.40AF.00
  Metric: 10   IS 0000.0C00.3E51.05
```

As the output shows, in addition to the information displayed with **show isis database**, the **show isis database detail** command displays the contents of each LSP.

Table 17-39 describes the fields shown in the display.

**Table 17-39 Show IS-IS Database Detail Field Descriptions**

| Field | Description |
|---|---|
| LSPID | The link state PDU ID. The first six octets form the System ID. The next octet is the pseudo ID. When this value is zero, the LSP describes links from the system. When it is nonzero, the LSP is a pseudonode LSP. The designated router for an interface is the only system that originates pseudonode LSPs. The last octet is the LSP number. If there is more data than can fit in a single LSP, additional LSPs are sent with increasing LSP numbers. An asterisk (*) indicates that the LSP was originated by the local system. |
| LSP Seq Num | Sequence number for the LSP that allows other systems to determine if they have received the latest information from the source. |
| LSP Checksum | Checksum of the entire LSP packet. |
| LSP Holdtime | Amount of time the LSP remains valid, in seconds. |
| ATT | The attach bit. This indicates that the router is also a Level 2 router, and it can reach other areas. |
| P | The P bit. Detects if the IS is area partition repair capable. |
| OL | The Overload bit. Determines if the IS is congested. |
| Area Address: | Reachable area addresses from the router. |
| Metric: | IS-IS metric for the route. |

## Sample Display Using Show IS-IS Database Detail Displaying IP Addresses

The following is additional sample output from the **show isis database detail** command.This is a Level 2 LSP. The area address 39.0001 is the address of the area in which the router resides.

```
Router# show isis database detail l2

IS-IS Level-2 Link State Database
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
0000.0C00.1111.00-00* 0x00000006   0x4DB3        1194          0/0/0
  Area Address: 39.0001
  NLPID:       0x81 0xCC
  IP Address:  160.89.64.17
  Metric: 10   IS 0000.0C00.1111.09
  Metric: 10   IS 0000.0C00.1111.08
  Metric: 10   IP 160.89.65.0 255.255.255.0
  Metric: 10   IP 160.89.64.0 255.255.255.0
  Metric: 0    IP-External 10.0.0.0 255.0.0.0
```

Table 17-40 describes the fields shown in the display.

**Table 17-40 Show IS-IS Database Detail Field Descriptions**

| Field | Description |
|---|---|
| LSPID | The link state PDU ID. The first six octets form the System ID. The next octet is the pseudo ID. When this value is zero, the LSP describes links from the system. When it is nonzero, the LSP is a pseudonode LSP. The designated router for an interface is the only system that originates pseudonode LSPs. The last octet is the LSP number. If there is more data than can fit in a single LSP, additional LSPs are sent with increasing LSP numbers. An asterisk (*) indicates that the LSP was originated by the local system. |
| LSP Seq Num | Sequence number for the LSP that allows other systems to determine if they have received the latest information from the source. |
| LSP Checksum | Checksum of the entire LSP packet. |
| LSP Holdtime | Amount of time the LSP remains valid, in seconds. |
| ATT | The attach bit. This indicates that the router is also a Level 2 router, and it can reach other areas. |
| P | The P bit. Detects if the IS is area partition repair capable. |
| OL | The Overload bit. Determines if the IS is congested. |
| Area Address: | Reachable area addresses from the router. |
| NLPID | Indicates that both IP and OSI (0x0cc and 0x081 respectively) are supported in IS-IS for this router. |
| IP Address: | The IP address for the router is advertised in the LSP. |
| Metric: | IS-IS metric for the route. |
| Various addresses | The “IP” entries are the directly connected IP subnets the router is advertising (with associated metrics). The “IP-External” is a redistribute route. |

# show route-map

To display configured route-maps, use the **show route-map** EXEC command.

**show route-map** [*map-name*]

## Syntax Description

| | |
|---|---|
| *map-name* | (Optional) Name of a specific route-map |

## Command Mode

EXEC

## Sample Display

The following is sample output from the **show route-map** command:

```
Router# show route-map
route-map foo, permit, sequence 10
  Match clauses:
    tag 1 2
  Set clauses:
    metric 5
route-map foo, permit, sequence 20
  Match clauses:
    tag 3 4
  Set clauses:
    metric 6
```

Table 17-41 describes the fields shown in the display:

**Table 17-41 Show Route-map Field Descriptions**

| Field | Description |
|---|---|
| route-map | Name of the route-map. |
| permit | Indicates that the route is redistributed as controlled by the set actions. |
| sequence | Number that indicates the position a new route map is to have in the list of route maps already configured with the same name. |
| Match clauses<br>tag | Match criteria—conditions under which redistribution is allowed for the current route-map. |
| Set clauses<br>metric | Set actions—the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. |

## Related Commands

**redistribute**
**route-map**

# summary-address

To create aggregate IS-IS addresses, use the **summary-address** router configuration command. To restore the default, use the **no** form of this command.

**summary-address** *address mask* {**level-1** | **level-1-2** | **level-2**}
**no summary-address** *address mask* {**level-1** | **level-1-2** | **level-2**}

## Syntax Description

| | |
|---|---|
| *address* | Summary address designated for a range of addresses. |
| *mask* | IP subnet mask used for the summary route. |
| **level-1** | If **level-1** is specified, only routes redistributed into Level 1 are summarized with the configured address/mask value. |
| **level-1-2** | If specified, the summary router is injected into both a Level 1 area and a Level 2 subdomain. |
| **level-2** | If **level-2** is specified, routes learned by Level 1 routing will be summarized into the Level 2 backbone with the configured address/mask value. |

## Default

Disabled

## Command Mode

Router configuration

## Usage Guidelines

Multiple groups of addresses can be summarized for a given level. Routes learned from other routing protocols also can be summarized. The metric used to advertise the summary is the smallest metric of all the more specific routes. This command helps reduce the size of the routing table.

## Example

In the following configuration, summary address 10.1.0.0 includes address 10.1.1, 10.1.2, 10.1.3, 10.1.4, and so forth. Only the address 10.1.0.0 is advertised in an IS-IS Level 1 Link State PDU.

```
summary-address 10.1.0.0 255.255.0.0 level-1
```

# synchronization

To disable the synchronization between BGP and your IGP, use the **synchronization** router configuration command. To enable a router to advertise a network route without waiting for the IGP, use the **no** form of this command.

**synchronization**
**no synchronization**

## Syntax Description

This command has no arguments or keywords.

## Default

Enabled

## Command Mode

Router configuration

## Usage Guidelines

Usually, a BGP speaker does not advertise a route to an external neighbor unless that route is local or exists in the IGP. The **no synchronization** command allows a router to advertise a network route without waiting for the IGP. This feature allows routers within an autonomous system to have the route before BGP makes it available to other autonomous systems.

Use **synchronization** if there are routers in the autonomous system that do not speak BGP.

## Example

The following example enables the router to advertise a network route without waiting for the IGP:

```
router bgp 120
no synchronization
```

# table-map

To modify metric and tag values when the IP routing table is updated with BGP learned routes, use the **table-map** router configuration command. To disable this function, use the **no** form of the command.

**table-map** *route-map-name*
**no table-map** *route-map-name*

### Syntax Description

| | |
|---|---|
| *route-map-name* | Route map name, from the **route-map** command. |

### Default

Disabled

### Command Mode

Router configuration

### Usage Guidelines

This command adds the route map name defined by the **route-map** command to the IP routing table. This command is used to set the tag name and the route metric to implement redistribution.

You can use **match** clauses of route maps in the **table-map** command. IP access list, AS paths, and next-hop match clauses are supported.

### Example

In the following example, the router is configured to automatically compute the tag value for the BGP learned routes and to update the IP routing table.

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

### Related Commands

**match as-path**
**match ip address**
**match ip next-hop**
**route-map**

# timers basic (EGP, RIP, IGRP)

To adjust EGP, RIP, or IGRP network timers, use the **timers basic** router configuration command. To restore the default timers, use the **no** form of this command.

**timers basic** *update invalid holddown flush* [*sleeptime*]
**no timers basic**

## Syntax Description

| | |
|---|---|
| *update* | Rate in seconds at which updates are sent. This is the fundamental timing parameter of the routing protocol. |
| *invalid* | Interval of time in seconds after which a route is declared invalid; it should be three times the value of *update*. A route becomes invalid when there is an absence of updates that refresh the route. The route then enters holddown. The route is marked inaccessible and advertised as unreachable. However, the route is still used for forwarding packets. |
| *holddown* | Interval in seconds during which routing information regarding better paths is suppressed. It should be at least three times the value of *update*. A route enters into a holddown state when an update packet is received that indicates the route is unreachable. The route is marked inaccessible and advertised as unreachable. However, the route is still used for forwarding packets. When holddown expires, routes advertised by other sources are accepted and the route is no longer inaccessible. |
| *flush* | Amount of time in seconds that must pass before the route is removed from the routing table; the interval specified must be at least the sum of *invalid* and *holddown*. If it is less than this sum, the proper holddown interval cannot elapse, which results in a new route being accepted before the holddown interval expires. |
| *sleeptime* | (Optional) For IGRP only, interval in milliseconds for postponing routing updates in the event of a flash update. The *sleeptime* value should be less than the *update* time. If the *sleeptime* is greater than the *update* time, routing tables will become unsynchronized. |

## Default

| Protocol | update | invalid | holddown | flush | sleeptime |
|---|---|---|---|---|---|
| EGP | N/A | 1080 | N/A | 1200 | N/A |
| RIP | 30 | 180 | 180 | 240 | N/A |
| IGRP | 90 | 270 | 280 | 630 | 0 |

## Command Mode

Router configuration

## Usage Guidelines

The basic timing parameters for IGRP, EGP, and RIP are adjustable. Since these routing protocols are executing a distributed, asynchronous routing algorithm, it is important that these timers be the same for all routers in the network.

---

**Note** The current and default timer values can be seen by inspecting the output of the **show ip protocols** EXEC command. The relationships of the various timers should be preserved as described previously.

---

## Examples

In the following example, updates are broadcast every 5 seconds. If a router is not heard from in 15 seconds, the route is declared unusable. Further information is suppressed for an additional 15 seconds. At the end of the suppression period, the route is flushed from the routing table.

```
router igrp 109
timers basic 5  15  15  30
```

Note that by setting a short update period, you run the risk of congesting slow-speed serial lines; however, this is not a big concern on faster-speed Ethernets and T1-rate serial lines. Also, if you have many routes in your updates, you can cause the routers to spend an excessive amount of time processing updates.

When the **timers basic** command is used with EGP, the update time and holddown time are ignored. For example, the commands that follow will set the invalid time for EGP to 100 seconds and the flush time to 200 seconds.

```
router egp 47
timers basic 0 100 0 200
```

# timers bgp

To adjust BGP network timers, use the **timers bgp** router configuration command. To reset the BGP timing defaults, use the **no** form of this command.

**timers bgp** *keepalive holdtime*
**no timers bgp**

## Syntax Description

| | |
|---|---|
| *keepalive* | Frequency, in seconds, with which the router sends *keepalive* messages to its peer. The default is 60 seconds. |
| *holdtime* | Interval, in seconds, after not receiving a *keepalive* message that the router declares a peer dead. The default is 180 seconds. |

## Default

*keepalive*: 60 seconds
*holdtime*: 180 seconds

## Command Mode

Router configuration

## Example

The following example changes the keepalive timer to 70 seconds and the holdtime timer to 210 seconds:

```
timers bgp 70 210
```

## Related Commands

**clear ip bgp**
**router bgp**
**show ip bgp**

# timers egp

To adjust EGP Hello and polltime network timers, use the **timers egp** router configuration command. The **no timers egp** command resets the EGP timing defaults.

**timers egp** *hello polltime*
**no timers egp**

## Syntax Description

| | |
|---|---|
| *hello* | Frequency, in seconds, with which the router sends Hello messages to its peer. The default is 60 seconds. |
| *polltime* | Interval, in seconds, for how frequently to exchange updates. The default is 180 seconds. |

## Default

*hello*: 60 seconds
*polltime*: 180 seconds

## Command Mode

Router configuration

## Usage Guidelines

To change the invalid time or flush time for EGP routes, use the **timers basic** router configuration command.

## Example

The following example changes the EGP timers to 2 minutes and 5 minutes, respectively:

```
timers egp 120 300
```

## Related Commands

**router egp**
**show ip egp**
**timers basic**

# timers spf

To configure the delay time between when OSPF receives a topology change and when it starts a shortest path first (SPF) calculation, and the hold time between two consecutive SPF calculations, use the **timers spf** router configuraiton command. To return to the default timer values, use the **no** form of this command.

**timers spf** *spf-delay spf-holdtime*
**no timers spf** *spf-delay spf-holdtime*

## Syntax Description

| | |
|---|---|
| *spf-delay* | Delay time, in seconds, between when OSPF receives a topology change and when it starts a SPF. calculation. It can be an integer from 0 to 65535. The default time is 5 seconds. A value of 0 means that there is no delay; that is, the SPF calculation is started immediately. |
| *spf-holdtime* | Minimum time, in seconds, between two consecutive SPF calculations. It can be an integer from 0 to 65535. The default time is 10 seconds. A value of 0 means that there is no delay; that is, two consecutive SPF calculations can be done one immediately after the other. |

## Default

*spf-delay*: 5 seconds
*spf-holdtime*: 10 seconds

## Command Mode

Router configuration

## Usage Guidelines

Setting the delay and hold time low causes routing to switch to the alternate path more quickly in the event of a failure. However, it consumes more CPU processing time.

## Example

The following example changes the delay to 10 seconds and the hold time to 20 seconds:

```
timers spf 10 20
```

# traffic-share

To control how traffic is distributed among routes when there are multiple routes for the same destination network that have different costs, use the **traffic-share** router configuration command. To disable this function, use the **no** form of the command.

**traffic-share** {**balanced** | **min**}
[**no**] **traffic share** {**balanced** | **min**}

## Syntax Description

| | |
|---|---|
| **balanced** | Distributes traffic proportionately to the ratios of the metrics. |
| **min** | Uses routes that have minimum costs. |

## Default

Traffic is distributed proportionately to the ratios of the metrics.

## Command Mode

Router configuration

## Usage Guidelines

This command applies to IGRP and enhanced IGRP routing protocols only. With the default setting, routes that have higher metrics represent less-preferable routes and get less traffic. Configuring **traffic-share min** causes the router to only divide traffic among the routes with the best metric. Other routes will remain in the routing table, but will receive no traffic.

## Example

In the following example, only routes of minimum cost will be used:

```
router igrp 5
traffic-share min
```

# validate-update-source

To have the router to validate the source IP address of incoming routing updates for RIP and IGRP routing protocols, use the **validate-update-source** router configuration command. To disable this function, use the **no** form of this command.

**validate-update-source**
**no validate-update-source**

## Syntax Description

This command has no arguments or keywords.

## Default

Enabled

## Command Mode

Router configuration

## Usage Guidelines

This command is only applicable to RIP and IGRP. The router ensures that the source IP address of incoming routing updates is on the same IP network as one of the addresses defined for the receiving interface.

Disabling split horizon on the incoming interface will also cause the system to perform this validation check.

For unnumbered IP interfaces (interfaces configured as **ip unnumbered**), no checking is performed.

## Example

In the following example, the router is configured to not perform validation checks on the source IP address of incoming RIP updates:

```
router rip
network 128.105.0.0
no validate-update-source
```

# variance

To control load balancing in an Enhanced IGRP-based internetwork, use the **variance** router configuration command. To reset the variance to the default value, use the **no** form of this command.

**variance** *multiplier*
**no variance**

## Syntax Description

| | |
|---|---|
| *multiplier* | Metric value used for load balancing. It can be a value from 1 to 128. The default is 1, which means equal-cost load balancing. |

## Default

1 (equal-cost load balancing)

## Command Mode

Router configuration

## Usage Guidelines

Setting a variance value lets the router determine the feasibility of a potential route. A route is feasible if the next router in the path is closer to the destination than the current router and if the metric for the entire path is within the variance. Only paths that are feasible can be used for load balancing and included in the routing table.

If the following two conditions are met, the route is deemed feasible and can be added to the routing table:

1. The local best metric must be greater than the metric learned from the next router.
2. The multiplier times the local best metric for the destination must be greater than or equal to the metric through the next router.

## Example

The following example sets a variance value of 4:

```
router igrp 109
variance 4
```