

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 *Access and Communication Servers Configuration Guide*.

aggregate-address

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

```
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

<i>address</i>	Aggregate address.
<i>mask</i>	Aggregate mask.
as-set	(Optional) Generates autonomous system set path information.
summary-only	(Optional) Filters more specific routes from updates.
suppress-map <i>map-name</i>	(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 Do not use this form of **aggregate-address** when aggregating many paths, because this route must be continually withdrawn and re-updated as autonomous system path reachability information for the summarized routes changes.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 autonomous system 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 as-path
match ip address
route-map

area authentication

Use the **area authentication** router configuration command to enable authentication for an OSPF area. Use the **no** form of this command with the **authentication** keyword to remove the area's authentication specification. Use the command **no area area-id** (with no other keywords) to remove the specified area from the communication server's configuration.

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 communication servers in an area. The authentication password for all OSPF communication servers 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.

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

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

```
area area-id default-cost cost  
no area area-id default-cost cost
```

Syntax Description

<i>area-id</i>	Identifier for the stub area. The identifier can be specified as either a decimal value or as an IP address.
<i>cost</i>	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 (ABR) 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 communication servers 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 ABR attached to the stub area. The **default-cost** option provides the metric for the summary default route generated by the ABR 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

Use the **area range** router configuration command to consolidate and summarize routes at an area boundary. Use the **no** form of this command to disable this function for the specified area.

```
area area-id range address mask  
no area area-id range address mask
```

Syntax Description

<i>area-id</i>	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.
<i>address</i>	IP address.
<i>mask</i>	IP mask.

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

This command is only used with communication servers acting as Area Border Routers (ABRs). 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 ABR. 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 communication server acting as an ABR 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

Use the **area stub** router configuration command to define an area as a stub area. Use the **no** form of this command to disable this function for the specified area.

```
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

This command must be configured on all communication servers in the stub area. Use the **area** router configuration command with the **default-cost** option to specify the cost of a default internal communication server sent into a stub area by a communication server acting as an Area Border Router (ABR).

There are two stub area router configuration commands: the **stub** and **default-cost** options of the **area** router configuration command. In all communication servers 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 ABR attached to the stub area. The **default-cost** option provides the metric for the summary default route generated by the ABR 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

<i>area-id</i>	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.
<i>router-id</i>	Router ID associated with the virtual link neighbor. The router ID appears in the show ip ospf display. It is internally derived by each communication server from the communication server'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 communication server sends on an interface.
<i>seconds</i>	(Optional) Unsigned integer value to be advertised in the communication server's Hello packets. The value must be the same for all communication servers 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.
<i>seconds</i>	(Optional) Expected round-trip delay between any two communication servers 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.
<i>seconds</i>	(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 communication server's Hello packets are not seen before its neighbors declare the communication server down.

<i>seconds</i>	(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 communication servers attached to a common network.
authentication-key	(Optional) Password to be used by neighboring communication servers.
<i>password</i>	(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 communication servers 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 communication server 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 communication server.

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 Command

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

area authentication

service password-encryption †

show ip ospf

autonomous-system (EGP)

Use the **autonomous-system** global configuration command to specify the local autonomous system that the communication server resides in for EGP. Use the **no** form of this command to remove the autonomous system number.

```
autonomous-system local-as  
no autonomous-system local-as
```

Syntax Description

local-as Local autonomous system number to which the communication server 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 communication server.

Example

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

```
autonomous-system 110
```

Related Command

router egp

auto-summary

To restore the default behavior 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.

Example

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

bgp default local-preference

Use the **bgp default local-preference** router configuration command to change the default local preference value of 100. Use the **no** form of this command to revert to the default setting.

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 communication servers 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

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

```
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

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

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

<i>*</i>	Resets all current BGP sessions.
<i>address</i>	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 resets 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* | *type number*]

Syntax Description

ip-address (Optional) Address of the neighbor.

type (Optional) Interface type.

number (Optional) Interface number.

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 | type number]
```

Syntax Description

<i>group-name</i>	(Optional) Name of the multicast group, as defined in the DNS hosts table or with the ip host command.
<i>group-address</i>	(Optional) Address of the multicast group. This is a multicast IP address in four-part dotted notation.
<i>type</i>	(Optional) Interface type.
<i>number</i>	(Optional) Interface 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 communication server 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.
<i>group-name</i>	Name of the multicast group, as defined in the DNS hosts table or with the ip host command.
<i>group-address</i>	Address of the multicast group. This is a multicast IP address in four-part dotted notation.
<i>source-address</i>	(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 <i>source-address</i> , you must specify either <i>group-name</i> or <i>group-address</i> .

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

Use the **clear ip route** EXEC command to remove one or more routes from the IP routing table.

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

Syntax Description

<i>network</i>	Network or subnet address to remove.
<i>mask</i>	(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 <i>map-tag</i> is the identifier of a configured route map. If you specify route-map without specifying <i>map-tag</i> , 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 doing 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 candidate default information out of 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
```

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

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

default-information originate (BGP)

Use the **default-information originate** router configuration command to allow the redistribution of network 0.0.0.0 into BGP. Use the **no** form of this command to prevent the redistribution of network 0.0.0.0 into BGP.

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)

Use the **default-information originate** router configuration command to explicitly configure EGP to generate a default route. Use the **no** form of this command to disable this function.

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 (OSPF)

Use the **default-information originate** router configuration command to generate a default route into an OSPF routing domain. Use the **no** form of this command to disable generation of a default route into the specified OSPF routing domain.

```
default-information originate [always] [metric metric-value] [metric-type type-value]
[route-map map-name]
no default-information originate [always] [metric metric-value] [metric-type type-value]
[route-map map-name]
```

Syntax Description

originate	For OSPF, causes the communication server to generate a default external route into an OSPF domain if the communication server already has a default route and you want to propagate to other communication servers.
always	(Optional) For OSPF, the default route always will be advertised whether or not the communication server has a default route.
metric <i>metric-value</i>	(Optional) Metric used for generating the default 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 10. The value used is specific to the protocol.
metric-type <i>type-value</i>	(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: 1 —Type 1 external route 2 —Type 2 external route If a metric-type is not specified, the communication server adopts a Type 2 external route.
route-map <i>map-name</i>	(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 communication server 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 communication server 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.

Examples

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 igmp 108 metric 100 subnets
 default-information originate metric 100 metric-type 1
```

Related Command

redistribute

default-metric

Use the **default-metric** router configuration command to set default metric values for the RIP, EGP, IGRP, Enhanced IGRP, and BGP routing protocols. Use the **no** form of this command to remove the metric value and return to the default state.

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

Syntax Description

<i>number</i>	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

This 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 communication server in autonomous system 109 using both the RIP and the IGRP routing protocols. The example advertises IGRP-derived routes using the RIP protocol and assigns the IGRP-derived routes a RIP metric of 10.

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

Related Command

redistribute

default-metric (IGRP)

Use this form of the **default-metric** router configuration command to set metrics for IGRP. Use the **no** form of this command to remove the metric value and return to the default state.

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

Syntax Description

<i>bandwidth</i>	Minimum bandwidth of the route in kilobits per second
<i>delay</i>	Route delay in tens of microseconds
<i>reliability</i>	Likelihood of successful packet transmission expressed as a number between 0 and 255 (255 is 100 percent reliability)
<i>loading</i>	Effective bandwidth of the route expressed as a number between 0 and 255 (255 is 100 percent loading)
<i>mtu</i>	Minimum Maximum Transmission Unit (MTU) size for the route

Default

Built-in, automatic metric translations

Command Mode

Router configuration

Usage Guidelines

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

Automatic metric translations for IGRP are only supported when redistributing from IGRP or static.

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

<i>weight</i>	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 <i>weight</i> specifies a default administrative distance that the communication server uses when no other specification exists for a routing information source. Routes with a distance of 255 are not installed in the routing table.
<i>address</i>	(Optional) IP address in four-part dotted notation.
<i>mask</i>	(Optional) IP address mask in four-part dotted-decimal format. A bit set to 1 in the <i>mask</i> argument instructs the communication server to ignore the corresponding bit in the address value.
<i>access-list-number</i>	(Optional) Number of a standard IP access list to be applied to incoming routing updates.
ip	(Optional) IP-derived routes for IS-IS. Can be applied independently for IP routes and ISO CLNS routes.

Default

Default administrative distances are shown in Table 18-1.

Table 18-1 Default Administrative Distances

Route Source	Default Distance
Connected interface	0
Static route	1
External BGP	20
IGRP	100
OSPF	110
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 communication server supplying the routing information. This could be used, as an example, to filter out possibly incorrect routing information from communication servers 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 communication server to ignore all routing updates from communication servers for which an explicit distance has not been set. The second **distance** command sets the administrative distance for all communication servers on the Class C network 192.31.7.0 to 90. The third **distance** command sets the administrative distance for the communication server 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

<i>external-distance</i>	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.
<i>internal-distance</i>	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.
<i>local-distance</i>	Administrative distance for BGP local routes. Local routes are those networks listed with a network router configuration command, often as back doors, for that communication server 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 communication server or a group of communication servers. 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 internal and external administrative distances 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

<i>internal-distance</i>	Administrative distance for IP 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. The default is 90.
<i>external-distance</i>	Administrative distance for IP 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. The default is 170.

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 communication server or a group of communication servers. 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 IP Enhanced IGRP or if some internal routes should really be preferred by IP Enhanced IGRP.

Table 18-2 lists the default administrative distances.

Table 18-2 Default Enhanced IGRP 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 IP Enhanced IGRP routing in autonomous system number 109. The **network** router configuration commands specify IP 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 communication server to ignore all routing updates from communication servers for which an explicit distance has not been set. The second **distance** router configuration command sets the administrative distance for all communication servers on the Class C network 192.31.7.0 to 90. The third **distance** router configuration command sets the administrative distance for the communication server 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 [type number]  
no distribute-list access-list-number in [type number]
```

Syntax Description

<i>access-list-number</i>	Standard IP access list number. The list defines which networks are to be received and which are to be suppressed in routing updates.
<i>type</i>	(Optional) Interface type.
<i>number</i>	(Optional) Interface number.

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

If no interface is specified, the access list will be applied to all incoming updates.

Example

The following example causes only two networks to be accepted by a RIP routing process: network 0.0.0.0 (the RIP default) 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 rip  
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
```


Related Commands

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

access-list †

distribute-list in

redistribute

ip address

Use the **ip address** interface configuration command to specify the IP address on an interface. Use the **no** form of this command to remove the specified secondary address.

```
ip address address mask [secondary]  
no ip address address mask [secondary]
```

Syntax Description

<i>address</i>	IP address
<i>mask</i>	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 communication servers 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, communication server-based network. Communication servers 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 communication server on a network segment uses a secondary address, all other communication servers 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 Ethernet interface 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

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

```
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

<i>access-list-number</i>	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.
<i>as-regular-expression</i>	Autonomous system in the access list using a regular expression. See the “Regular Expressions” appendix for information on 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

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

```
ip default-network network-number  
no ip default-network network-number
```

Syntax Description

network-number Number of the network

Default

If the communication server has a directly connected interface onto the specified network, the dynamic routing protocols running on that communication server 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 communication server 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 specified subnet.

Examples

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

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

If the following command was issued on a communication server not connected to network 129.140.0.0, the communication server 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

<i>access-list-number</i>	Number of a standard IP access list. This can be a number from 1 to 99. A value of 0 means that all sources are accepted with the configured distance.
<i>distance</i>	(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

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

<i>metric</i>	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).
<i>access-list-number</i>	(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.
<i>protocol</i>	(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.) If you specify these arguments, only routes learned by the specified routing protocol are advertised in DVMRP report messages.
<i>process-id</i>	(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 communication servers.

Command Mode

Interface configuration

Usage Guidelines

When PIM is configured on an interface and DVMRP neighbors are discovered, the communication server 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.

If you do not specify this command, only directly connected subnets are advertised via DVMRP.

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 communication servers 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

A dagger (†) indicates that the command is documented in the *Debug Command Reference* publication.

debug ip dvmrp †
ip dvmrp accept-filter

ip gdp

Use the **ip gdp** interface configuration command to enable GDP routing on an interface. Use the **no** form of this command to disable GDP routing, with all default parameters.

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

Syntax Description

priority <i>number</i>	(Optional) Alters the GDP priority; default is a priority of 100. A larger number indicates a higher priority.
reporttime <i>seconds</i>	(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 <i>seconds</i>	(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 Ethernet interface 1 with a report time of 10 seconds, and priority and hold time set to their defaults (because none are specified):

```
interface ethernet 1  
ip gdp reporttime 10
```

ip hello-interval eigrp

To configure the hello interval for the IP 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

<i>autonomous-system-number</i>	A decimal number between 1 and 65535.
<i>seconds</i>	Hello interval, in seconds

Default

5 seconds

Command Mode

Interface configuration

Example

The following example sets the hello interval for Ethernet interface 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 IP 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

<i>autonomous-system-number</i>	A decimal number between 1 and 65535.
<i>seconds</i>	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 communication server does not receive a hello packet within the specified hold time, routes through the communication server 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 on 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

<i>access-list-number</i>	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 communication server 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

<i>group-address</i>	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 communication server.

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

Another reason to have a communication server 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 communication server join the multicast group causes upstream communication servers to maintain multicast routing table information for that group and keeps the paths for that group active.

Example

In the following example, the communication server joins multicast group 225.2.2.2:

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

Related Commands

ip igmp access-group
ping

ip igmp query-interval

To configure the frequency at which the communication server 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 value from 0 to 65535. The default is 60 seconds.

Default

60 seconds

Command Mode

Interface configuration

Usage Guidelines

Multicast communication servers send host membership query messages (referred to as host-query messages) to discover which multicast groups have members on the communication server'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 communication server 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

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

```
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 <i>seconds</i>	(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 <i>seconds</i>	(Optional) Maximum interval in seconds between advertisements. The default is 600 seconds.
minadvertinterval <i>seconds</i>	(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 <i>number</i>	(Optional) Communication server's preference value. The allowed range is -2^{31} to 2^{31} . The default is 0. A higher value increases the communication server's preference level. You can modify a particular communication server so that it will be the preferred communication server to which others home.
address <i>address</i> [<i>number</i>]	(Optional) IP address (<i>address</i>) to proxy advertise, and optionally, its preference value (<i>number</i>).

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 communication server 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 communication server 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 communication server, 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 keywords or arguments.

Default

IP multicast routing is disabled.

Command Mode

Global configuration

Usage Guidelines

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

Example

The following example enables IP multicast routing on the communication server:

```
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 t  
no ip multicast-threshold [t]
```

Syntax Description

t 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 on 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, communication servers 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

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

```
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 communication server originates routing protocol packets. A separate password can be assigned to each network on a per-interface basis. All neighboring communication servers on the same network must have the same password to be able to exchange OSPF information.

Note A communication server 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 communication server'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 as follows:

$$10^8 \text{ Bandwidth}$$

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

Use the **ip ospf dead-interval** interface configuration command to set the number of seconds that a communication server's Hello packets must not have been seen before its neighbors declare the communication server down. Use the **no** form of this command to reset the length of time to the default value.

```
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 for the **ip ospf hello-interval** command

Command Mode

Interface configuration

Usage Guidelines

The interval is advertised in the communication server's Hello packets. This value must be the same for all communication servers 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

Use the **ip ospf hello-interval** interface configuration command to specify the interval between Hello packets that the communication server sends on the interface. Use the **no** form of this command to reset the interval to the default value.

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 communication server'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 communication servers 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 network

Use the **ip ospf network** interface configuration command to configure the OSPF network type to a type other than the default for a given media. Use the **no** form of this command to restore the default.

```
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 communication servers 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

frame-relay map
neighbor (OSPF)
x25-map

ip ospf priority

Use the **ip ospf priority** interface configuration command to set the communication server's priority, which helps determine the designated communication server for this network. Use the **no** form of this command to reset the communication server priority to the default value.

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 communication servers attached to a network both attempt to become the designated communication server; the one with the higher priority takes precedence. If there is a tie, the communication server with the higher ID takes precedence. A communication server with a priority set to zero is ineligible to become the designated communication server or backup designated communication server. Communication server 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 communication server 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 number of seconds between link state advertisement retransmissions for adjacencies belonging to the interface, use the **ip ospf retransmit-interval** interface configuration command. Use the **no** form of this command to reset the link state advertisement retransmission interval to the default value.

```
ip ospf retransmit-interval seconds  
no ip ospf retransmit-interval
```

Syntax Description

<i>seconds</i>	Number of seconds between retransmissions; it must be greater than the expected round-trip delay between any two communication servers 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 communication server 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

Use the **ip ospf transmit-delay** interface configuration command to set the estimated number of seconds it takes to transmit a link state update packet on the interface. Use the **no** form of this command to reset the estimated transmission time to the default value.

```
ip ospf transmit-delay seconds  
no ip ospf transmit-delay
```

Syntax Description

seconds Integer that specifies the number of seconds it takes to transmit a link state update. The range is 1 to 65535 seconds.

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 ospf-name-lookup

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

```
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 communication server because it is displayed by name rather than by its communication server 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.

```
cs# 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    cs            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    cs            381     0x80000001   0xC117
```

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 (Optional) Enables dense mode of operation.

sparse-mode (Optional) 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 communication server populates its multicast routing table and how the communication server 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 communication servers or there is a directly connected member on the interface.

Initially, a dense-mode interface forwards multicast packets until the communication server determines that there are group members or downstream communication servers, or until a prune message is received from a downstream communication server. 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 communication servers never send a join message. They do send prune messages as soon as they determine they have no members or downstream PIM communication servers.

A sparse-mode interface is used only for multicast forwarding if a join message is received from a downstream communication server 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 communication servers want to join the shared path, they periodically send join messages toward the RP. When sparse-mode communication servers 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 command enables sparse-mode PIM on tunnel interface 0 and sets the address of the RP communication server 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 multicast routing 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 message-interval

To configure the frequency at which a sparse-mode PIM communication server sends periodic sparse-mode join/prune PIM messages, use the **ip pim message-interval** global configuration command. To return to the default interval, use the **no** form of this command.

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

Syntax Description

seconds Interval, in seconds, at which periodic sparse-mode join and prune PIM messages are sent. It can be a number from 1 to 65535. The default is 60 seconds.

Default

60 seconds

Command Mode

Global configuration

Usage Guidelines

The join-and-prune message interval should be the same for all communication servers in the internetwork.

A communication server is pruned from a group if a join message is not heard from it in three times the message interval specified by the *seconds* argument. By default, this is 3 minutes.

Note Changing this value may severely impact multicast forwarding.

Example

The following example changes the PIM message interval to 90 seconds:

```
ip pim message-interval 90
```

Related Commands

ip igmp query-interval
ip pim query-interval

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

<i>seconds</i>	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 communication server 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 communication server 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 Command

ip igmp query-interval
ip pim message-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

<i>ip-address</i>	IP address of a communication server to be a PIM RP. This is a unicast IP address in four-part dotted notation.
<i>access-list-number</i>	(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 in the range 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 communication servers 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 communication servers to send register packets on behalf of source multicast hosts to the RP. This address is also used by communication servers 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 communication server; 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 communication server 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 communication server 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 communication server can use multiple RPs.

First-hop communication servers for multicast sources send register packets to all configured RPs. First-hop communication servers for multicast group members send join packets to one RP at a time. Once this communication server begins receiving multicast packets for the group, it will have joined one RP tree. Because the communication server 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  
ip pim rp-address 147.106.6.22 1
```

Related Command

access-list

ip route

Use the **ip route** global configuration command to establish static routes. Use the **no** form of this command to remove the static routes.

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

Syntax Description

<i>network</i>	Internet address of the target network or subnet
<i>mask</i>	(Optional) Network mask that lets you mask network and subnetwork bits
<i>address</i>	Internet address of the next hop that can be used to reach that network
<i>interface</i>	Network interface to use
<i>distance</i>	(Optional) An administrative distance

Default

No static routes are established.

Command Mode

Global configuration

Usage Guidelines

A static route is appropriate when the communication server 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 communication server 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 communication server at 131.108.6.6:

```
ip route 131.108.0.0 255.255.0.0 131.108.6.6
```

ip split-horizon

Use the **ip split-horizon** interface configuration command to enable the split-horizon mechanism. Use the **no** form of this command to turn off the split-horizon mechanism.

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 communication servers 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 communication servers 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
```

ip split-horizon eigrp

To enable IP 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 A decimal number between 1 and 65535.

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 communication servers 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 communication servers 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 Commands

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

<i>autonomous-system-number</i>	A decimal number between 1 and 65535.
<i>address</i>	IP summary aggregate address to apply to an interface
<i>mask</i>	Subnet mask

Default

No summary aggregate addresses are predefined.

Command Mode

Interface configuration

Usage Guidelines

IP 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

match as-path

Use the **match as-path** route-map configuration command to match a BGP autonomous system path access list. Use the **no** form of this command to remove the path list entry.

```
match as-path path-list-number  
no match as-path path-list-number
```

Syntax Description

<i>path-list-number</i>	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 to 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 autonomous system 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

<i>type</i>	Interface type
<i>number</i>	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 to 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 Ethernet interface 0 will be distributed:

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

Related Commands

route-map
set

match ip address

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

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

Syntax Description

access-list-number One or more numeric identifiers of access lists. 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 to 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

Use the **match ip next-hop** route-map configuration command to redistribute any routes that have a next-hop communication server address passed by one of the access lists specified. Use the **no** form of this command to remove the next-hop entry.

```
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 to 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 communication server 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

Use the **match ip route-source** route-map configuration command for any routes that have been advertised by communication servers at the address specified by the access lists. Use the **no** form of this command to remove the route-source entry.

```
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 to 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 communication server address are not the same.

Example

In the following example, routes that have been advertised by communication servers 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

Use the **match metric** route-map configuration command for any routes with the metric specified. Use the **no** form of this command to remove the entry.

match metric *metric-value*
no match metric *metric-value*

Syntax Description

metric-value Route metric. This may be an IGRP five-part metric. 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 to 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

Use the **match route-type** route-map configuration command for any routes that are of the specified type. Use the **no** form of this command to remove the route-type entry.

```
match route-type { internal | external }  
no match route-type { internal | external }
```

Syntax Description

internal	OSPF intra-area and interarea routes or Enhanced IGRP internal routes
external	OSPF external type-1 or type-2 routes, or Enhanced IGRP external 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

Use the **match tag** command for any routes stored in the routing table with one of the tags specified. Use the **no** form of this command to remove the tag entry.

```
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. 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 to 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 [tvl]
```

Syntax Description

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

Command Mode

EXEC

Usage Guidelines

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

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

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

It is important to specify a value for the *tvl* argument if you are tracing through a communication server 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 communication servers 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 18-3 describes the fields shown in the display.

Table 18-3 Mbranch Field Descriptions

Field	Description
Response from 10.17.118.10	Address of the communication server from which the response to the trace request packets came. This is a different interface on the communication server to which you sent the packet.
76 msec	How long it took to receive the response.
1	Order number of communication servers in the trace path. In this example, the request went through 3 communication servers to reach the communication server 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 communication server PIM2 to the communication server PIM9 (PIM2 is considered to be PIM9's RPF neighbor), then from PIM9 to PIM-CR, and finally to the communication server 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 communication server 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 communication server 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

Use the **metric holddown** router configuration command to keep new IGRP routing information from being used for a certain period of time. Use the **no** form of this command to disable metric holddown.

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 communication servers within the IGRP autonomous system are not configured with **no metric holddown**. If all communication servers 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

Use the **metric maximum-hops** router configuration command to cause 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 **no** form of this command to reset the value to the default.

```
metric maximum-hops hops  
no metric maximum-hops hops
```

Syntax Description

<i>hops</i>	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 communication server 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

Use the **metric weights** router configuration command to allow the tuning of the IGRP metric calculations. Use the **no** form of this command to reset the values to their defaults.

```
metric weights tos k1 k2 k3 k4 k5  
no metric weights
```

Syntax Description

<i>tos</i>	Type of service. Currently it must always be zero.
<i>k1–k5</i>	Constants that convert an 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 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 10×10^{10} . The range is from a 1200 bps line to 10 Gbps.

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 24-bit field, in tens of microseconds. Hence, the delay can be from 1 (10 microseconds) to hex FFFFFFF (decimal 16777215), which corresponds to 167.77215 seconds. A delay of all ones (that is, a delay of 16777215) indicates that the network is unreachable.

Table 18-4 lists the default values used for several common media.

Table 18-4 Bandwidth Values by Media Type

Media Type	Delay	Bandwidth
Satellite	200,000 (2 sec)	20 (500 Mbit)
Ethernet	100 (1 ms)	1,000
1.544 Mbps	2000 (20 ms)	6,476
64 kbps	2000	156,250
56 kbps	2000	178,571
10 kbps	2000	1,000,000
1 kbps	2000	10,000,000

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

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

Command Mode

EXEC

Usage Guidelines

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

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

The communication server with the address *branch-address* responds to the trace request packets. The requesting communication server then sends a query to the communication server that is the first communication server'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 communication servers between the source communication server and the specified branch communication server.

Sample Display

The following is sample output from the **mrbranch** command. This example is between the same communication server 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 18-5 describes the fields shown in the display.

Table 18-5 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 communication server from which the response to the trace request packets came.
1	Order number of communication servers 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 communication server 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 communication server would use as the next-hop communication server (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 communication server 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

mtrace

To trace the entire multicast tree for the specified group, use the **mtrace** user EXEC command.

```
mtrace {group-address | group-name} [tll]
```

Syntax Description

<i>group-address</i>	Address of the multicast group. This is a multicast IP address in four-part dotted notation.
<i>group-name</i>	Name of the multicast group, as defined in the DNS hosts table or with the ip host command.
<i>tll</i>	(Optional) Time-to-live value. Communication servers at a distance of <i>tll</i> hops from the local communication server respond with a record of the path to each of them. The <i>tll</i> argument can be a number from 0 to 32. The default value is 1, which generates responses from all communication servers directly connected to the local communication server.

Command Mode

EXEC

Usage Guidelines

The trace request generated by the **mtrace** command is multicast to the multicast group. Responses are unicast to the source communication server.

Responses are delayed by the responders.

Note Use the **mtrace** command with caution, because it can cause a very large number of packets to be directed to the source communication server. Consider using the **mbranch** command instead to trace an individual branch of the tree.

Sample Display

The following is sample output from the **mtrace** command:

```

cs> mtrace 224.0.255.1
Type escape sequence to abort.
Tracing route to group CBONE-AUDIO (224.0.255.1)

Response from PIM4 (198.92.36.131), 7 msec
  1 PIM4 (198.92.36.131) <- 0.0.0.0
    Interface list: 198.92.37.0/24 10.20.0.0/16
Response from PIM3 (198.92.36.130), 4 msec
  1 PIM3 (198.92.36.130) <- 0.0.0.0
    Interface list: 198.92.35.160/27
Response from PIM4 (198.92.37.33), 2 msec
  1 PIM4 (198.92.37.33) <- 0.0.0.0
    Interface list: 10.20.0.0/16
Response from PIM9 (10.1.22.9), 20 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
Response from ITCHY (198.92.37.2), 3 msec
  1 ITCHY (198.92.37.2) <- 0.0.0.0
    Interface list: Null

```

Table 18-6 describes the fields shown in the display.

Table 18-6 Mtrace Field Descriptions

Field	Description
Tracing route to group CBONE-AUDIO (224.0.255.1)	Name and address of group for which routes are being traced.
Response from PIM4 (198.92.37.33)	Address of the communication server from which the response to the trace request packets came.
7msec	How long it took to receive the response.
Interface list: 198.92.37.0/24 10.20.0.0/16	Interface out which a multicast packet from the communication server listed on the right side of the previous line will be forwarded.

Related Commands

mbranch
mrbranch

neighbor (EGP, IGRP, RIP)

Use this form of the **neighbor** router configuration command to define a neighboring communication server with which to exchange routing information. Use the **no** form of this command to remove an entry.

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

Syntax Description

ip-address IP address of a peer communication server with which routing information will be exchanged

Default

No neighboring communication servers 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 communication servers 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 Ethernet interface 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)

Use this form of the **neighbor** router configuration command to configure OSPF communication servers interconnecting to nonbroadcast networks. Use the **no** form of this command with the appropriate IP address and arguments to remove the configuration.

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

Syntax Description

<i>ip-address</i>	Interface IP address of the neighbor.
priority number	(Optional) 8-bit number indicating the communication server 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 communication server 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 communication server’s configuration for each known nonbroadcast network neighbor. The neighbor address has to be on the primary address of the interface.

If a neighboring communication server 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 communication server first starts up, it sends only Hello packets to those communication servers with non-zero priority, that is, communication servers that are eligible to become designated routers and backup designated routers. After designated routers and backup designated routers are selected, they will then start sending Hello packets to all neighbors in order to form adjacencies.

Example

The following example declares a communication server 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

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

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

Syntax Description

<i>address</i>	Neighbor address.
<i>tag</i>	Neighbor tag.
<i>seconds</i>	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

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

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

Syntax Description

<i>access-list-number</i>	(Optional) Access list number the neighbor <i>must</i> 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 communication server.
---------------------------	---

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

Use the **neighbor any third-party** router configuration command to configure an EGP process that determine which neighbors will be treated as the next hop in EGP advertisements. Use the **no** form of this command to remove the configuration.

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

Syntax Description

<i>ip-address</i>	IP address of the third-party communication server that is to be the next hop in EGP advertisements.
internal	(Optional) Indicates that the third-party communication server should be listed in the internal section of the EGP update.
external	(Optional) Indicates that the third-party communication server 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 specifies 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

Use the **neighbor configure-neighbors** router configuration command to instruct the communication server to treat temporary neighbors that have been accepted by a template as if they had been configured by hand. The **no** form of this command causes any new neighbor accepted by the template to be treated as temporary.

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

Syntax Description

template-name A user selectable designation that identifies a particular template (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 communication server because you had configured a template are treated as temporary. When a temporary neighbor disconnects, the local communication server will not try to actively reestablish a connection with it. In addition, information about temporary neighbors will not show up in the communication server 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 communication server 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

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

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

Syntax Description

<i>ip-address</i>	Neighbor's IP address.
<i>access-list-number</i>	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 autonomous system-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

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

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

Use the **neighbor filter-list** router configuration command to set up BGP filters, using access lists defined with the **ip as-path access-list** command. Use the **no** form of this command to disable this function.

```
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

<i>ip-address</i>	IP address of the neighbor.
<i>access-list-number</i>	Predefined autonomous system path access list number.
in	Access list to incoming routes.
out	Access list to outgoing routes.
weight <i>weight</i>	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

Use the **neighbor neighbor-list** router configuration command to configure BGP to support anonymous neighbor peers by configuring a neighbor template. Use the **no** form of this command to delete the template, and also cause any temporary neighbors accepted by the template to be shut down and removed.

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

Syntax Description

<i>template-name</i>	A user selectable designation that identifies a particular template (an arbitrary word).
<i>access-list-number</i>	An IP access list 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 communication server. 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 communication server configuration. When the session is disconnected, all knowledge about the neighbor is discarded and the communication server will not attempt to actively re-establish a connection.

You can use the **neighbor configure-neighbors** command to request that the communication server 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.

Examples

In the following example, any BGP speaker from 168.89.3.0 can connect to the communication server 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 communication server, and the local communication server will send them routing information. However, the distribute-list clause instructs the local communication server 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

Use the **neighbor next-hop-self** router configuration command to configure the communication server to disable next-hop processing on BGP updates. Use the **no** form of this command to disable this feature.

```
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 communication server as the next hop:

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

neighbor remote-as

Use the **neighbor remote-as** router configuration command to add an entry to the BGP neighbor table. Use the **no** form of this command to remove a neighbor.

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

Syntax Description

<i>ip-address</i>	Neighbor's IP address
<i>number</i>	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 communication server 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 communication server is assigned to autonomous system 109, and two networks are listed as originating in the autonomous system. Then the addresses of three remote communication servers (and their autonomous systems) are listed. The communication server being configured will share information about networks 131.108.0.0 and 192.31.7.0 with the neighbor communication servers. The first communication server 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

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

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

Syntax Description

<i>address</i>	Neighbor's IP address
<i>tag</i>	Neighbor tag
<i>route-map-name</i>	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

Use the **neighbor third-party** router configuration command to send updates regarding EGP third-party communication servers. Use the **no** form of this command to disable these updates.

```
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

<i>ip-address</i>	IP address of the EGP peer.
<i>third-party-ip-address</i>	Address of the third-party communication server on the network shared by the Cisco communication server and the EGP peer specified by <i>address</i> .
internal	(Optional) Indicates that the third-party communication server should be listed in the internal section of the EGP update. This is the default.
external	(Optional) Indicates that the third-party communication server 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 communication server (the third party) on the shared network is the appropriate communication server for some set of destinations. If updates mentioning third-party communication servers are desired, use this command.

All networks reachable through the third-party communication server will be listed in the EGP updates as reachable by the communication server. The optional **internal** and **external** keywords indicate whether the third-party communication server 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 communication servers.

Examples

In the following example, routes learned from communication server 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

Use the **neighbor update-source** router configuration command to configure the communication server to allow internal BGP sessions to use any operational interface for TCP connections. Use the **no** form of this command to restore the interface assignment to the closest interface, also called the *best-local-address*.

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

Syntax Description

<i>ip-address</i>	IP address of the BGP-speaking neighbor
<i>interface</i>	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 *Access and Communication Servers 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

Use the **neighbor version** router configuration command to configure the communication server to accept only a particular version. Use the **no** form of this command to return the version to the default level of that neighbor.

```
neighbor ip-address version value  
no neighbor ip-address version value
```

Syntax Description

<i>ip-address</i>	IP address of the BGP-speaking neighbor.
<i>value</i>	Version number. The version can be set to 2 to force the communication server 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

Use the **neighbor weight** router configuration command to specify a weight to assign to a specific neighbor connection. Use the **no** form of this command to remove the assignment.

```
neighbor ip-address weight weight  
no neighbor ip-address weight weight
```

Syntax Description

<i>ip-address</i>	Neighbor's IP address.
weight <i>weight</i>	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 communication server 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

network (BGP)

Use this form of the **network** router configuration command to specify the list of networks for the BGP routing process. Use the **no** form of this command to remove the entry.

```
network network-number mask network-mask
no network network-number mask network-mask
```

Syntax Description

<i>network-number</i>	IP address of a peer communication server with which routing information will be exchanged
mask	Network or subnetwork mask
<i>network-mask</i>	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 131.108.1.27 to be included in the communication server's BGP updates:

```
router bgp 120
 network 131.108.1.27 mask 255.255.255.0
```

Related Commands

```
network backdoor
network mask
network weight
router bgp
```

network (EGP)

Use this form of the **network** router configuration command to specify the list of networks for the EGP routing process. Use the **no** form of this command to remove a network from the list.

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

Syntax Description

<i>network-number</i>	IP address of a peer communication server 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 communication server process. The communication server is in autonomous system 109 and is peering with communication servers in autonomous system 164. It will advertise the networks 131.108.0.0 and 192.31.7.0 to the communication server in autonomous system 164, 10.2.0.2. The information sent and received from peer communication servers can be filtered in various ways, including blocking information from certain communication servers 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 (Enhanced IGRP)

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

```
network network-number  
no network network-number
```

Syntax Description

network-number IP address of the directly connected network

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

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

IP Enhanced IGRP sends updates to the interfaces in the specified network(s). Also, if you do not specify an interface's network, it will not be advertised in any IP Enhanced IGRP updates.

Example

The following example configures a communication server for IP Enhanced IGRP and assigns autonomous system number 109. The **network** commands indicate the networks directly connected to the communication server.

```
router eigrp 109  
network 131.108.0.0  
network 192.31.7.0
```

Related Command

router eigrp

network (IGRP)

Use this form of the **network** router configuration command to specify a list of networks for the IGRP routing process. Use the **no** form of this command to remove a network from the list.

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 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 update.

Example

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

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

Related Command

router igrp

network (RIP)

Use this form of the **network** router configuration command to specify a list of networks for the RIP routing process. Use the **no** form of this command to remove a network from the list.

```
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 networks. 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

Use the **network area** router configuration command to define the interfaces on which OSPF runs and to define the area ID for those interfaces. Use the **no** form of this command to disable OSPF routing for interfaces defined with the *address wildcard-mask* pair; you must specify the complete address range and area ID.

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

Syntax Description

<i>address</i>	IP address.
<i>wildcard-mask</i>	IP-address-type mask that includes “don’t care” bits.
<i>area-id</i>	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 <i>area-id</i> .

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 communication server 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 communication server 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 communication server 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

Use the **network backdoor** router configuration command to specify a backdoor route to a BGP border communication server that will provide better information about the network. Use the **no** form of this command to remove an address from the list.

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

Use the **network weight** router configuration command to assign an absolute weight, or importance, to a BGP network. Use the **no** form of this command to delete the entry.

```
network address weight weight  
no network address weight weight
```

Syntax Description

<i>address</i>	IP address of the network.
weight <i>weight</i>	Absolute weight. 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

The following example assigns network 193.0.0.0 an absolute weight of 100:

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

offset-list

Use the **offset-list** router configuration command to add or remove a positive offset to incoming and outgoing metrics for networks matching a specified access list (for IGRP and RIP only). Use the **no** form of this command with the appropriate keywords to remove the offset list.

```
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.
<i>offset</i>	Positive offset to be applied to metrics for networks matching the access list. If the offset is zero, no action is taken.
<i>access-list-number</i>	(Optional) Access list to be applied. If unspecified, the argument supplied to <i>offset</i> is applied to all metrics. If <i>offset</i> 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.

Example

The following example for a communication server using IGRP applies an offset of 10 to its delay component for all outgoing metrics:

```
offset-list out 10
```

passive-interface

Use the **passive-interface** router configuration command to disable sending routing updates on an interface. Use the **no** form of this command to reenable sending routing updates on the specified interface.

```
passive-interface type number  
no passive-interface type number
```

Syntax Description

<i>type</i>	Interface type
<i>number</i>	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 communication servers on that interface continue to be received and processed.

IP Enhanced IGRP is disabled on an interface that is configured as passive although it advertises the route.

For OSPF, OSPF routing information is neither sent nor received through the specified communication server interface. The specified interface address appears as a stub network in the OSPF domain.

Example

The following example sends IGRP updates to all interfaces on network 131.108.0.0 except Ethernet interface 1:

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

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

<i>protocol</i>	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 . The keyword static [ip] is used to redistribute IP static routes. The optional ip keyword is used when redistributing into IS-IS. 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.
<i>process-id</i>	(Optional) For bgp , egp , or igrp , this is an autonomous system number, which is a 16-bit decimal number. For isis , this is an optional <i>tag</i> that defines a meaningful name for a routing process. You can specify only one IS-IS process per communication server. Creating a name for a routing process means that you use names when configuring routing. 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. For rip , no <i>process-id</i> 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 <i>metric-value</i>	(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 <i>type-value</i>	(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: 1 —Type 1 external route 2 —Type 2 external route If a metric-type is not specified, the communication server adopts a Type 2 external route. For IS-IS, it can be one of two values: internal —IS-IS metric which is < 63. external —IS-IS metric which is > 64 < 128. 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: internal —Routes that are internal to a specific autonomous system. external 1 —Routes that are external to the autonomous system, but are imported into OSPF as type 1 external route. external 2 —Routes that are external to the autonomous system, but are imported into OSPF as type 2 external route.
tag <i>tag-value</i>	(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.
<i>map-tag</i>	(Optional) Identifier of a configured route map.
weight <i>weight</i>	(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.

Defaults

Route redistribution is disabled.

protocol—No source protocol is defined.

process-id—No process ID is defined.

metric *metric-value*—0

metric-type *type-value*—Type 2 external route

match **internal** | **external**—internal

external *type-value*—internal

tag *tag-value*—If no value is specified, the remote autonomous system number is used for routes

from BGP and EGP; for other protocols, the default is 0.

route-map *map-tag*—If the **route-map** argument is not entered, all routes are redistributed; if no *map-tag* value is entered, no routes are imported.

weight *weight*—No network weight is defined.

subnets—No subnets are defined.

Command Mode

Router configuration

Usage Guidelines

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

A communication server receiving a link-state protocol (LSP) with an internal metric will consider the cost of the route from itself to the redistributing communication server 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, a communication server acting as a communication server 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 IGP's 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 allowed

distribute-list out

route-map

show route-map

route-map

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. Use the **no** form of this command to delete the entry.

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

Syntax Description

<i>map-tag</i>	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.
<i>sequence-number</i>	(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 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

Use the **router bgp** global configuration command to configure the Border Gateway Protocol (BGP) routing process. Use the **no** form of this command to remove the routing process.

router bgp *autonomous-system*
no router bgp *autonomous-system*

Syntax Description

<i>autonomous-system</i>	Identifies the communication server to other BGP communication servers 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

Use the **router egp** global configuration command to configure the Exterior Gateway Protocol (EGP) routing process. Use the **no** form of this command to turn off the EGP routing process.

```
router egp remote-as  
no router egp remote-as
```

Syntax Description

<i>remote-as</i>	Identifies the autonomous system number the communication server 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 communication server. 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 communication server to autonomous system 109 and is peering with communication servers in autonomous system 164:

```
autonomous-system 109  
router egp 164
```

Related Commands

autonomous-system
neighbor
network (EGP)
timers egp

router egp 0

Use the **router egp 0** global configuration command to specify that a communication server should be considered a core gateway. Use the **no** form of this command to disable this function.

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 communication server.

The **router egp 0** global configuration command allows a specific communication server 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 IP Enhanced IGRP routing process, use the **router eigrp** global configuration command. To shut down the routing process on the specified autonomous system, use the **no** form of this command.

```
router eigrp process-number  
no router eigrp process-number
```

Syntax Description

process-number

Number of a process that identifies the routes to other IP Enhanced IGRP communication servers. It is also used to tag the routing information. If you have an autonomous system number, you can use it for the process number.

Default

Disabled

Command Mode

Global configuration

Example

The following example shows how to configure an IP Enhanced IGRP routing process and assign autonomous system number 109:

```
router eigrp 109
```

Related Command

network

router igrp

Use the **router igrp** global configuration command to configure the Interior Gateway Routing Protocol (IGRP) routing process. Use the **no** form of this command to shut down the routing process on the specified autonomous system.

```
router igrp process-number  
no router igrp process-number
```

Syntax Description

<i>process-number</i>	Number of a process that identifies the routes to other IP Enhanced IGRP communication servers. It is also used to tag the routing information. If you have an autonomous system 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 autonomous system 109:

```
router igrp 109
```

Related Command

network (IGRP)

router ospf

Use the **router ospf** global configuration command to configure an OSPF routing process on a communication server. Use the **no** form of this command to terminate an individual OSPF routing process.

```
router ospf process-id  
no router ospf process-id
```

Syntax Description

<i>process-id</i>	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 communication server.

Example

The following example shows how to configure an OSPF routing process and assign a process ID of 109:

```
router ospf 109
```

Related Command

network (OSPF)

router rip

Use the **router rip** global configuration command to configure the Routing Information Protocol (RIP) routing process. Use the **no** form of this command to turn off the RIP routing process.

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

Use the **set automatic-tag** route-map configuration command to automatically compute the tag value. Use the **no** form of this command to disable this function.

```
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 communication server 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

Use the **set level** route-map configuration command to indicate where to import routes. Use the **no** form of this command to delete the entry.

```
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-1
```

Related Commands

match

route-map

set local-preference

Use the **set local-preference** route-map configuration command to specify a preference value for autonomous system path. Use the **no** form of this command to delete the entry.

```
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 communication servers 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

Use the **set metric** route-map configuration command to set the metric value for the destination routing protocol. Use the **no** form of this command to return to the default metric value.

```
set metric metric-value  
no set metric metric-value
```

Syntax Description

<i>metric-value</i>	Metric value or IGRP bandwidth in kilobits per second. 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

Use the **set metric-type** route-map command to set the metric type for the destination routing protocol. Use the **no** form of this command to disable the metric type for the destination routing protocol.

```
set metric-type {type-1 | type-2}
no set metric-type {type-1 | type-2}
```

Syntax Description

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

Use the **set next-hop** route-map configuration command to specify the address of the next hop. Use the **no** form of this command to delete the entry.

```
set next-hop next-hop  
no set next-hop next-hop
```

Syntax Description

next-hop IP address of the next hop communication server

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

Use the **set origin** route-map configuration command to set the BGP origin code. Use the **no** form of this command to delete the entry.

```
set origin {igp | egp remote-as | incomplete}
```

Syntax Description

igp	Remote EGP.
egp	Local IGP.
<i>remote-as</i>	Remote autonomous system. 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

Use the **set tag** route-map configuration command to set a tag value of the destination routing protocol. Use the **no** form of this command to delete the entry.

```
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

Use the **set weight** route-map configuration command to specify the BGP weight for the routing table. Use the **no** form of this command to delete the entry.

```
set weight weight  
no set weight weight
```

Syntax Description

weight Weight value. From 0 through 65535.

Default

The weight will not be 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 autonomous system 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

Use the **show ip bgp** EXEC command to display a particular network in the BGP routing table.

```
show ip bgp [network] [network-mask] [subnets]
```

Syntax Description

<i>network</i>	(Optional) Network number, entered to display a particular network in the BGP routing table.
<i>network-mask</i>	(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:

```
cs# show ip bgp
BGP table version is 716977, local communication server 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      100      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      100      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      100      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      100      0 1878 704 701 i
```

Table 18-7 describes significant fields shown in the display.

Table 18-7 Show IP BGP Field Descriptions

Field	Description
BGP table version is 716977	Internal version number for the table. This is incremented any time the table changes.
local communication server ID	An Internet address of the communication server.
Status codes	Asterisk (*) indicates that the table entry is valid. A > character indicates that the table entry is the best entry to use for that network. A lowercase "i" indicates that the table entry was learned via an internal BGP session. A lowercase "s" indicates that the table entry is suppressed.
Network	Internet address of the network the entry describes.
Next Hop	IP address of the next system to use when forwarding a packet to the destination network. An entry of 0.0.0.0 indicates that the communication server has some non-BGP route to this network.
Metric	If shown, this is the value of the interautonomous system metric. This is frequently not used.
Weight	Set through the use of 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. At the end of the path is the origin code for the path. A lowercase "i" indicates that the entry was originated with the IGP and advertised with a network router configuration command. A lowercase "e" indicates that the route originated with EGP. A question mark (?) indicates that the origin of the path is not clear. Usually this is a path that is redistributed into BGP from an IGP.
LocPrf	Local preference value. Default is 100.

The following is sample output from the **show ip bgp subnets** command:

```

cs# show ip bgp 198.92.0.0 255.255.0.0 subnets
BGP table version is 1738, local communication server 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

Use the **show ip bgp cidr-only** privileged EXEC command to display only routes with non-natural network masks.

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 for the **show ip bgp cidr-only** command:

```
cs# show ip bgp cidr-only
BGP table version is 220, local communication server 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 ?
```

Table 18-7 describes significant fields shown in the display.

Table 18-8 Show IP BGP CIDR-Only Field Descriptions

Field	Description
BGP table version is 220	Internal version number for the table. This is incremented any time the table changes.
local communication server ID	An Internet address of the communication server.
Status codes	<ul style="list-style-type: none"> s The table entry is suppressed. * The table entry is valid. > The table entry is the best entry to use for that network. i The table entry was learned via an internal BGP session.
Network	Internet address of the network the entry describes.
Next Hop	IP address of the next system to use when forwarding a packet to the destination network. An entry of 0.0.0.0 indicates that the communication server has some non-BGP route to this network.
LocPrf	Local preference value. Default is 100.
Metric	If shown, this is the value of the interautonomous system metric. This is frequently not used.
Weight	Set through the use of autonomous system filters.

Field	Description
Path	<p data-bbox="698 283 1404 378">Autonomous system paths to the destination network. There can be one entry in this field for each autonomous system in the path. At the end of the path is the origin code for the path.</p> <ul data-bbox="698 378 1404 558" style="list-style-type: none"><li data-bbox="698 378 1404 451">i The entry was originated with the IGP and advertised with a network router configuration command.<li data-bbox="698 451 1404 493">e The route originated with EGP.<li data-bbox="698 493 1404 558">? The origin of the path is not clear. Usually this is a path that is redistributed into BGP from an IGP.

show ip bgp filter-list

Use the **show ip bgp filter-list** privileged EXEC command to display routes that conform to a specified filter list.

```
show ip bgp filter-list access-list-number
```

Syntax Description

access-list-number Regular expression access list number from 1 through 199

Command Mode

Privileged EXEC

Sample Display

The following is sample output from the **show ip bgp filter-list** command:

```
cs# show ip bgp filter-list 2
BGP table version is 1738, local communication server 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 ?
```

Table 18-7 describes significant fields shown in the display.

Table 18-9 Show IP BGP Filter-List Field Descriptions

Field	Description
BGP table version is 1738	Internal version number for the table. This is incremented any time the table changes.
local communication server ID	An Internet address of the communication server.
Status codes	<ul style="list-style-type: none"> s The table entry is suppressed. * The table entry is valid. > The table entry is the best entry to use for that network. i The table entry was learned via an internal BGP session.

Field	Description
Network	Internet address of the network the entry describes.
Next Hop	IP address of the next system to use when forwarding a packet to the destination network. An entry of 0.0.0.0 indicates that the communication server has some non-BGP route to this network.
LocPrf	Local preference value. Default is 100.
Metric	If shown, this is the value of the interautonomous system metric. This is frequently not used.
Weight	Set through the use of 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. At the end of the path is the origin code for the path. <ul style="list-style-type: none">i The entry was originated with the IGP and advertised with a network router configuration command.e The route originated with EGP.? The origin of the path is not clear. Usually this is a path that is redistributed into BGP from an IGP.

show ip bgp neighbors

Use the **show ip bgp neighbors** EXEC command to display detailed information on the TCP and BGP connections to individual neighbors.

```
show ip bgp neighbors [address] [routes | paths]
```

Syntax Description

<i>address</i>	(Optional) Address of the neighbor whose routes you have learned from
routes	(Optional) Routes of specified neighbors
paths	(Optional) Autonomous system path of specified neighbor

Command Mode

EXEC

Sample Display

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

```
cs# show ip bgp neighbors

BGP neighbor is 131.108.6.68, remote AS 10, external link
BGP version 3, remote communication server 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 18-10 describes significant fields shown in the display.

Table 18-10 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 communication server, 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 communication server is BGP version 3; the neighbor's communication server 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.

Sample Display

The following is sample output from the **show ip bgp neighbors paths** command:

```

cs# show ip bgp neighbors 198.92.72.24 paths
Address      Refcount Metric Path
0x3BAE7C      41      0 1878 ?
0x3BA714      3       0 1878 1755 i
0x3BA58C      1       0 1878 i
    
```

Table 18-11 describes significant fields shown in the display.

Table 18-11 Show IP BGP Neighbors Paths Field Descriptions

Field	Description
Address	Internal address where the 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: <ul style="list-style-type: none">i The entry was originated with the IGP and advertised with a network router configuration command.e The route originated with EGP.? The origin of the path is not clear. Usually this is a path that is redistributed into BGP from an IGP.

show ip bgp paths

Use the **show ip bgp paths** EXEC command to display all the BGP paths in the database.

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:

```
cs# 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 18-11 describes significant fields shown in the display.

Table 18-12 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

Use the **show ip bgp regexp** privileged EXEC command to display routes matching the regular expression.

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

```
cs# show ip bgp regexp 108$
BGP table version is 1738, local communication server 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

Use the **show ip bgp summary** EXEC command to display the status of all BGP connections.

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:

```

cs# 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 18-13 describes significant fields shown in the display.

Table 18-13 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 18-14 describes the fields shown in the display

Table 18-14 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 communication server 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

Use the **show ip egp** EXEC command to display statistics on EGP connections and neighbors.

```
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:

```
cs# 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 18-15 describes the fields shown in the display.

Table 18-15 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. Temp—Temporary (neighbor will be removed). Act—Active, controlling the connection. Pass—Passive, neighbor controls the connection.

show ip eigrp neighbors

To display the neighbors discovered by IP Enhanced IGRP, use the **show ip eigrp neighbors EXEC** command.

```
show ip eigrp neighbors [type number]
```

Syntax Description

type (Optional) Interface type

number (Optional) Interface 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:

```
cs# 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 18-16 explains the fields in the output.

Table 18-16 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 communication server is receiving hello packets from the peer.
Holdtime	Length of time, in seconds, that the communication server 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 communication server first heard from this neighbor.
Q Count	Number of IP Enhanced IGRP packets (Update, Query, and Reply) that the communication server 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 IP Enhanced IGRP packet to be sent to this neighbor and for the local communication server to receive an acknowledgment of that packet.
RTO	Retransmission timeout, in milliseconds. This is the amount of time the communication server waits before retransmitting a packet from the retransmission queue to a neighbor.

show ip eigrp topology

To display the IP Enhanced IGRP topology table, use the **show ip eigrp topology** EXEC command.

show ip eigrp topology [*autonomous-system-number* | [[*ip-address*] *mask*]]

Syntax Description

<i>autonomous-system-number</i>	(Optional) A decimal number between 1 and 65535.
<i>ip-address</i>	(Optional) When specified with a mask, a detailed description of the entry is provided.
<i>mask</i>	(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:

```

cs# 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 18-17 explains the fields in the output.

Table 18-17 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 communication server 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 communication server 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 communication server 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 IP 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) A decimal number between 1 and 65535.

Command Mode

EXEC

Sample Display

The following is sample output from the **show ip eigrp traffic** command:

```
cs# 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 18-18 describes the fields that might be shown in the display.

Table 18-18 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 communication server and that were learned via IGMP, use the **show ip igmp groups** EXEC command.

```
show ip igmp groups [group-name | group-address | type number]
```

Syntax Description

<i>group-name</i>	(Optional) Name of the multicast group, as defined in the DNS hosts table.
<i>group-address</i>	(Optional) Address of the multicast group. This is a multicast IP address in four-part dotted notation.
<i>type</i>	(Optional) Interface type.
<i>number</i>	(Optional) Interface 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 of the **show ip igmp groups** command:

```
cs> 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 18-19 describes the fields shown in the display.

Table 18-19 Show IP IGMP Groups Field Descriptions

Field	Description
Group address	Address of the multicast group.
Interface	Interface through which the group is reachable.

Field	Description
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 Command
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

<i>type</i>	(Optional) Interface type.
<i>number</i>	(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 communication servers on the interface.

Sample Display

The following is sample output from the **show ip igmp interface** command:

```
cs> 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 18-20 describes the fields shown in the display.

Table 18-20 Show IP IGMP Interface Field Descriptions

Field	Description
Ethernet0 is up, line protocol is up	Interface type, number, and status.
Internet address is... 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 communication server 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 in the autonomous system.
Multicast groups joined: 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

Use the **show ip irdp** EXEC command to display IRDP values.

```
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:

```
cs# show ip irdp

Ethernet 0 has communication server 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 communication server discovery disabled
--More--
Ethernet 1 has communication server discovery disabled
```

As the display shows, **show ip irdp** output indicates whether or not communication server discovery has been configured for each communication server interface, and lists the values of communication server discovery configurables for those interfaces on which communication server 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

<i>group-name</i>	(Optional) Name of the multicast group, as defined in the DNS hosts table.
<i>group-address</i>	(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 communication server, and multicast packets.
<i>source-address</i>	(Optional) Address of a communication server 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 communication server 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 communication server 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 system operating in dense mode. This command displays the contents of the IP multicast routing table for the multicast group named cbone-audio.

```
cs> 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 system operating in sparse mode:

```
cs# 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 18-21 explains the fields shown in the displays.

Table 18-21 Show IP Mroute Field Descriptions

Field	Description
Flags:	Provides information about the entry.
P - Prune	Route has been pruned. The communication server 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 communication server itself is a member of the multicast group.
(*, 224.0.255.1) (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 communication server followed by IP address of the multicast group. An asterisk (*) in place of the source communication server indicates all sources. 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) communication server. For communication servers 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 communication server 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 Sparse 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

Use the **show ip ospf** EXEC command to display general information about OSPF routing processes in a particular communication server.

```
show ip ospf [process-id]
```

Syntax Description

process-id (Optional) Specifies a 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:

```
cs# 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 communication server 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 18-22 describes significant fields shown in the display.

Table 18-22 Show IP OSPF Field Descriptions

Field	Description
Routing process "ospf 201" with ID 192.42.110.200	Process ID and OSPF communication server 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.

Field	Description
External Link update interval	Specify external update interval in hours:minutes:seconds, and time to next update.
Redistributing External Routes from	Lists of redistributed routes, by protocol.
Number of areas	Number of areas in the communication server, area addresses, and so on.
Link State Update Interval	Specify communication server 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

Use the **show ip ospf border-routers** privileged EXEC command to display the internal OSPF routing table entries to a communication server acting as an Area Border Router (ABR) or Autonomous System Boundary Router (ASBR).

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:

```
cs# 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 18-23 describes the fields shown in the display.

Table 18-23 Show IP OSPF Border-routers Field Descriptions

Field	Description
Destination	Destination communication server ID.
Next Hop	Next hop toward the destination.
Cost	Cost of using this route.
Type	The communication server 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

Use the **show ip ospf database** EXEC command to display lists of information related to the OSPF database for a specific communication server. The various forms of this command deliver information about different OSPF link state advertisements.

```
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 [asb-summary] [link-state-id]  
show ip ospf [process-id] database [external] [link-state-id]
```

Command Mode

EXEC

Syntax Description

<i>process-id</i>	(Optional) Internally used identification parameter. 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.
<i>area-id</i>	(Optional) Area number associated with the OSPF address range defined in the network router configuration command used to define the particular area.
<i>link-state-id</i>	(Optional) Identifies the portion of the Internet 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. When the link state advertisement is describing a network, the <i>link-state-id</i> can take one of two forms: —The network's IP address (as in type 3 summary link advertisements and in autonomous system external link advertisements). —A 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.) When the link state advertisement is describing a communication server, the link state ID is always the described communication server's OSPF communication server ID. When an autonomous system external advertisement (LS Type = 5) is describing a default route, its link state ID is set to Default Destination (0.0.0.0).

When entered with the optional keywords **router**, **network**, **summary**, **asb-summary**, and **external**, different displays result. Examples and brief descriptions of each form follow.

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:

```

cs# 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 18-24 describes significant fields shown in the display.

Table 18-24 Show IP OSPF Database Field Descriptions

Field	Description
Link ID	Communication server ID number.
ADV Router	Advertising communication server's ID.
Age	Link state age.
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 communication server.

Sample Display Using Show IP OSPF Database Router

The following is sample output from the **show ip ospf database communication server** command when no optional arguments are specified:

```

cs# 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 18-25 describes significant fields shown in the display.

Table 18-25 Show IP OSPF Database Router Field Descriptions

Field	Description
Router ID	Communication server 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 communication server's 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 communication server type.
Number of Links	Number of active links.
link ID	Link type.
Link Data	Communication server interface address.
TOS	Type of Service metric (Type 0 only).

Sample Display Using Show IP OSPF Database Network

The following is sample output from the **show ip ospf database network** command when no optional arguments are specified:

```
cs# 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 18-26 describes significant fields shown in the display.

Table 18-26 Show IP OSPF Database Network Field Descriptions

Field	Description
OSPF Router with ID(190.20.239.66)	Communication server 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 communication server.
Advertising Router	Advertising communication server's 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 communication server type.
Other fields	List of communication servers attached to the network, by IP address.

Sample Display Using Show IP OSPF Database Summary

The following is sample output from the **show ip ospf database summary** command when no optional arguments are specified:

```

cs# 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 18-27 describes significant fields shown in the display.

Table 18-27 Show IP OSPF Database Summary Field Descriptions

Field	Description
Router ID	Communication server 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 communication server's 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 ASB-Summary

The following is sample output from the **show ip ospf database asb-summary** command when no optional arguments are specified:

```
cs# show ip ospf database asb-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 18-28 describes significant fields shown in the display.

Table 18-28 Show IP OSPF Database ASB-Summary Field Descriptions

Field	Description
Router ID	Communication server 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 communication server).
Advertising Router	Advertising communication server's 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 when no optional arguments are specified:

```

cs# 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 18-29 describes significant fields shown in the display.

Table 18-29 Show IP OSPF Database External Field Descriptions

Field	Description
Router ID	Communication server 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 communication server's 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.

show ip ospf interface

Use the **show ip ospf interface EXEC** command to display OSPF-related interface information.

```
show ip ospf interface [type number]
```

Syntax Description

<i>type</i>	(Optional) Interface type
<i>number</i>	(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:

```
cs# 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 communication server 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 18-30 describes significant fields shown in the display.

Table 18-30 Show IP OSPF Interface 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), communication server ID, network type, link state cost.
Transmit Delay	Transmit delay, interface state, and communication server priority.
Designated Router	Designated communication server ID and respective interface IP address.
Backup Designated router	Backup designated communication server 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

Use the **show ip ospf neighbor** EXEC command to display OSPF-neighbor information on a per-interface basis.

show ip ospf neighbor [*type number*] [*neighbor-id*] **detail**

Syntax Description

<i>type</i>	(Optional) Interface type
<i>number</i>	(Optional) Interface number
<i>neighbor-id</i>	(Optional) Neighbor ID
detail	Displays all neighbors given in detail (list all neighbors)

Command Mode

EXEC

Sample Display

The following is sample output from the **show ip ospf neighbor** command showing a single line of summary information for each neighbor:

```
cs# 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:

```
cs# 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 communication server displays the neighbors that match the Neighbor ID on the interface, as in the following sample display:

```
cs# show ip ospf neighbor ethernet 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:

```
cs# show ip ospf neighbor fddi 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:

```
cs# 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 18-31 describes significant fields shown in the previous displays.

Table 18-31 Show IP OSPF Neighbor Field Descriptions

Field	Description
Neighbor x.x.x.x	Neighbor communication server 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	Communication server 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 communication server will declare neighbor dead.

show ip ospf virtual-links

Use the **show ip ospf virtual-links EXEC** command to display the parameters and current state of OSPF virtual links.

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:

```
cs# show ip ospf virtual-links

Virtual Link to communication server 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 18-32 describes significant fields shown in the display.

Table 18-32 Show IP OSPF Virtual-links Field Descriptions

Field	Description
Virtual Link to communication server 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 [type number]
```

Syntax Description

type (Optional) Interface type.

number (Optional) Interface 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:

```
cs> 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 18-33 describes the fields shown in the display.

Table 18-33 Show IP PIM Interface Field Description

Field	Description
Address	IP address of the next-hop communication server.
Interface	Interface type and number that is configured to run PIM.
Mode	Multicast mode in which the communication server 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 communication server, use the **show ip pim neighbor** EXEC command.

```
show ip pim neighbor [type number]
```

Syntax Description

type (Optional) Interface type.

number (Optional) Interface number.

Command Mode

EXEC

Usage Guidelines

Use this command to determine which communication servers on the LAN are configured for PIM.

Sample Display

The following is sample output from the **show ip pim neighbor** command:

```
cs> show ip pim neighbor
PIM Neighbor Table
Neighbor Address Interface      Uptime    Expires
198.92.37.2      Ethernet0   17:38:16  0:01:25
198.92.37.33     Ethernet0   17:33:20  0:01:05 (DR)
198.92.36.131    Ethernet1   17:33:20  0:01:08 (DR)
198.92.36.130    Ethernet1   18:56:06  0:01:04
10.1.22.9        Tunnel0     19:14:59  0:01:09
```

Table 18-34 describes the fields shown in the display.

Table 18-34 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.
(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) communication servers 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

<i>group-name</i>	(Optional) Name of the multicast group, as defined in the DNS hosts table.
<i>group-address</i>	(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 communication server that is not an RP:

```
cs> show ip pim rp
Group: 224.2.127.255, number of RPs: 1
  RP address: 198.92.37.2, state: Tunnel, uptime 0:01:25, expires in 0:03:04
```

The following is sample output from the **show ip pim rp** command from a communication server that is an RP:

```
cs# 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 18-35 explains the fields shown in the displays.

Table 18-35 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:	
uptime	
expires	
next RP-reachable in	

Related Command

show ip mroute

show ip protocols

Use the **show ip protocols** EXEC command to display the parameters and current state of the active routing protocol process.

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 communication server suspected of delivering bad routing information.

Sample Display

The following is sample output from the **show ip protocols** command, showing IGRP processes:

```
cs# 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 18-36 describes significant fields shown in the display.

Table 18-36 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 communication server is using to build its routing table. For each source, you will see displayed: <ul style="list-style-type: none"> • IP address • Administrative distance • Time the last update was received from this source.

show ip route

Use the **show ip route** EXEC command to display the current state of the routing table.

```
show ip route [ip-address [mask] | protocol [process-id]]
```

Syntax Description

<i>ip-address</i>	(Optional) Address about which to display routing information.
<i>mask</i>	(Optional) Subnet mask of the subnet about which to display routing information.
<i>protocol</i>	(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 .
<i>process-id</i>	(Optional) Identifier of the particular routing protocol process.

Command Mode

EXEC

Sample Display

The following is sample output from the **show ip route** command when entered without an address:

```
cs# 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
```

Table 18-37 describes significant fields shown in this display.

Table 18-37 Show IP Route Field Descriptions

Field	Description
O	Indicates protocol that derived the route. Possible values include the following: <ul style="list-style-type: none"> • I—IGRP derived • R—RIP derived • O—OSPF derived • C—connected • S—static • E—EGP derived • B—BGP derived
E2	Type of route. Possible values include the following: <ul style="list-style-type: none"> • *—candidate default route • IA—OSPF interarea route • E1—OSPF external type 1 route • E2—OSPF external type 2 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 communication server to the remote network.
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.

Sample Display Using an Address

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.

```

cs# 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 18-38 describes significant fields shown in this display.

Table 18-38 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 communication server that is the next hop to the remote network and the communication server 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.
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 communication server 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

Use the **show ip route summary** EXEC command to display the current state of the routing table.

```
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:

```
cs# 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          3          360
Total          751        17         32130      92160
cs#
```

Table 18-39 describes the fields shown in the display:

Table 18-39 Show IP Route Summary Field Descriptions

Field	Description
Route Source	Routing protocol name, or connected , static , or internal . Internal—those routes that are in the primary routing table merely as markers to hold subnet routes. These routes are not owned by any routing protocol. There should be one of these internal routes for each subnetted network in the routing table.
Networks	The number of Class A, B, or C networks that are present in the routing table for each route source.
Subnets	The 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 under “Memory.”
Memory	The number of bytes allocated to maintain all the routes for the particular route source.

Related Command

show ip route

show ip route supernets-only

Use the **show ip route supernets-only** privileged EXEC command to display information about supernets.

show ip route supernets-only

Command Mode

Privileged EXEC

Sample Display

The following is sample output from the **show ip route supernets-only** command:

```
cs# 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
```

This display shows supernets only; it does not show subnets.

show route-map

Use the **show route-map EXEC** command to display all route-maps configured or only the one specified.

```
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:

```
cs# 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 18-40 describes the fields shown in the display:

Table 18-40 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 tag	Match criteria—conditions under which redistribution is allowed for the current route-map.
Set clauses metric	Set actions—the particular redistribution actions to perform if the criteria enforced by the match commands are met.

Related Commands

redistribute
route-map

synchronization

Use the **synchronization** router configuration command to disable the synchronization between BGP and your IGP. Use the **no** form of this command to enable a communication server to advertise a network route without waiting for the IGP.

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 communication server to advertise a network route without waiting for the IGP. This feature allows communication servers within an autonomous system to have the route before BGP makes it available to other autonomous systems.

Use **synchronization** if there are communication servers in the autonomous system that do not speak BGP.

Example

The following example enables the communication server to advertise a network route without waiting for the IGP:

```
router bgp 120
no synchronization
```

table-map

Use the **table-map** router configuration command to modify metric and tag values when the IP routing table is updated with BGP learned routes. Use the **no** form of this command to disable this function.

```
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, autonomous system paths, and next-hop match clauses are supported.

Example

In the following example, the communication server 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)

Use the **timers basic** router configuration command to adjust EGP, RIP, or IGRP network timers. Use the **no** form of this command to restore the defaults.

```
timers basic update invalid holddown flush [sleeptime]  
no timers basic
```

Syntax Description

<i>update</i>	Rate (in seconds) at which updates are sent. This is the fundamental timing parameter of the routing protocol.
<i>invalid</i>	Interval of time (in seconds) after which a route is declared invalid; it should be three times the value of <i>update</i> . 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.
<i>holddown</i>	Interval (in seconds) during which routing information regarding better paths is suppressed. It should be at least three times the value of <i>update</i> . 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.
<i>flush</i>	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 <i>invalid</i> and <i>holddown</i> . 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.
<i>sleeptime</i>	(Optional) For IGRP only, interval (in milliseconds) for postponing routing updates in the event of a flash update. The <i>sleeptime</i> value should be less than the <i>update</i> time. If the <i>sleeptime</i> is greater than the <i>update</i> 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 communication servers 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 communication server 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 communication servers 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

Use the **timers bgp** router configuration command to adjust BGP network timers. Use the **no** form of this command to reset the BGP timing defaults.

timers bgp *keepalive holdtime*
no timers bgp

Syntax Description

<i>keepalive</i>	Frequency, in seconds, with which the communication server sends <i>keepalive</i> messages to its peer. The default is 60 seconds.
<i>holdtime</i>	Interval, in seconds, after not receiving a <i>keepalive</i> message that the communication server declares a peer dead. The default is 180 seconds.

Default

keepalive timer = 60 seconds
holdtime timer = 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

Use the **timers egp** router configuration command to adjust EGP Hello and polltime network timers. Use the **no** form of this command to reset the EGP timing defaults.

```
timers egp hello polltime  
no timers egp
```

Syntax Description

hello

Frequency, in seconds, with which the communication server 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 timer = 60 seconds
polltime timer = 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
```

traffic-share

Use the **traffic-share** router configuration command to control how traffic is distributed among routes when there are multiple routes for the same destination network that have different costs. Use the **no** form of this command to disable this function.

```
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 communication server to 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

Use the **validate-update-source** router configuration command to cause the communication server to validate the source IP address of incoming routing updates for RIP and IGRP routing protocols. Use the **no** form of this command to disable this validate function for RIP or IGRP.

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 communication server 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 communication server is configured to perform no validation checks on the source IP address of incoming RIP updates:

```
router rip
network 128.105.0.0
no validate-update-source
```

variance

Use the **variance** router configuration command to control load balancing in an IGRP-based internet. Use the **no** form of this command to reset variance to the default value.

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 this value lets the communication server determine the *feasibility* of a potential route. A route is *feasible* if the next communication server in the path is *closer* to the destination than the current communication server 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 communication server.
- 2 The *multiplier* times the local best metric for the destination must be greater than or equal to the metric through the next communication server.

Example

The following example sets a variance value of 4:

```
router igrp 109
variance 4
```