

IP Routing Protocol 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 *Communication Server Configuration Guide*.

area (authentication)

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

```
area area-id authentication  
no area area-id authentication  
no area area-id
```

Syntax Description

<i>area-id</i>	Identifier (ID) of the area for which authentication is to be enabled. The identifier can be specified as either a decimal value or an IP address.
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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

ip ospf authentication-key

area (default-cost)

area (stub)

area (default-cost)

Use the **area** router configuration command with the **default-cost** keyword to specify a specific 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 (ID) 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

1

Command Mode

Router configuration

Usage Guidelines

This command is used only on an area border communication server 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 area border communication server attached to the stub area. The **default-cost** option provides the metric for the summary default route generated by the area border communication server 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** router configuration command with the **range** keyword 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 (ID) 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 area border communication servers. It is used to consolidate or summarize routes for an area. The result is that a single summary route is advertised to other areas by the area border communication server. 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 specified. Thus, OSPF can summarize addresses for many different sets of address ranges.

Example

The following example specifies one summary route to be advertised by the area border communication server 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** router configuration command with the **stub** keyword 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 (ID) for the stub area. The identifier can be either a decimal value or an IP address.

Default

None

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 an area border communication server.

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 area border communication server attached to the stub area. The **default-cost** option provides the metric for the summary default route generated by the area border communication server 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)

Use the **area** router configuration command with the **virtual-link** keyword and the optional parameters to define an OSPF virtual link. Use the **no** form of this command to remove the virtual link.

```
area area-id virtual-link communication server-id [hello-interval number-of-seconds]
[retransmit-interval number-of-seconds]
[transmit-delay number-of-seconds]
[dead-interval number-of-seconds]
[authentication-key 8-bytes-of-password]
```

```
no area area-id virtual-link communication server-id [hello-interval number-of-seconds]
[retransmit-interval number-of-seconds]
[transmit-delay number-of-seconds]
[dead-interval number-of-seconds]
[authentication-key 8-bytes-of-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>communication server-id</i>	Router ID associated with the virtual link neighbor. The communication server 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.) Number of seconds between the Hello packets that the communication server sends on an interface.
<i>number-of-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.) Number of seconds between link state advertisement retransmissions for adjacencies belonging to the interface.
<i>number-of-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 number of seconds it takes to transmit a link state update packet on the interface.
<i>number-of-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.) Number of seconds that a communication server's Hello packets are not seen before its neighbors declare the communication server down.
<i>number-of-seconds</i>	(Optional.) Unsigned integer value. The default is four times the Hello interval. As with the Hello interval, this value must be the same for all communication servers attached to a common network.
authentication-key	(Optional.) Specific password to be used by neighboring communication servers.
<i>8-bytes-of-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. There is no default value.

Default

See "Syntax Description" for various defaults.

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.

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

area (authentication)

autonomous-system (EGP)

Use the **autonomous-system** global configuration command to specify the local autonomous system that the communication server resides in for EGP. To remove the AS number, use the **no autonomous-system** command.

```
autonomous-system local-AS  
no autonomous-system local-AS
```

Syntax Description

local-AS Local autonomous system (AS) number to which the communication server belongs.

Default

None

Command Mode

Global configuration

Usage Guidelines

Before you can set up EGP routing, you must specify an autonomous system number. The local AS 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

clear arp-cache

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

```
clear arp-cache
```

clear ip bgp

To reset a BGP connection, use the **clear ip bgp** EXEC command at the system prompt, using either of the optional arguments.

```
clear ip bgp [{* | address}]
```

Syntax Description

<i>*</i>	(Optional.) Resets all current BGP sessions.
<i>address</i>	(Optional.) 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

Example

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

```
clear ip bgp *
```

Related Commands

show ip bgp
timers bgp

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.
*	Remove all entries.

Default

None

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

Use the **default-information allowed** router configuration command to control exterior information between IGRP processes. The **no default-information allowed in** command causes IGRP exterior or default routes to be suppressed when received by an IGRP process. The **no default-information allowed out** command causes IGRP exterior routes to be suppressed in updates.

```
default-information allowed {in | out}
no default-information allowed {in | out}
```

Syntax Description

in	Allows IGRP exterior or default routes to be received by an IGRP process.
out	Allows IGRP exterior routes to be advertised in updates.

Default

Normally, exterior routes are always accepted and default information is passed between 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.

Example

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

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

default-information originate (EGP)

Use the **default-information originate** router configuration command to explicitly configure EGP to generate a default route. The **no default-information originate** command disables 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 cannot 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. The **no default-information originate** command disables 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 AS boundary communication server. However, an AS boundary communication server 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.

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 Commands

redistribute

default-metric

Use the **default-metric** router configuration command to set default metric values for the RIP, EGP, BGP, EIGRP, and enhanced EIGRP routing protocols. Use the **no default-metric** command to remove the metric value and return to the default state.

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

Syntax Description

number Default metric value appropriate for the specified routing protocol.

Default

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

Command Mode

Router configuration

Usage Guidelines

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 INTER_AS metric.

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 in kilobits per second.
<i>mtu</i>	Minimum Maximum Transmission Unit (MTU) size of 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 bgp

Use the **distance bgp** router configuration command to allow the use of three possible administrative distances—external, internal, and local—that could be a better route to a node. Use the **no distance bgp** command to reset these values to their defaults.

```
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 10 to 255.
<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 10 to 255.
<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 10 to 255.

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
```

distance

Use the **distance** router configuration command to define an administrative distance. Use the **no distance** command with the appropriate arguments to remove a distance definition.

```
distance weight [address mask [access-list-number]]  
no distance weight [address mask [access-list-number]]
```

Syntax Description

<i>weight</i>	Integer from 10 to 255 for the administrative distance. (Values 0 through 9 are reserved for internal use.) Used alone, the argument specifies a default administrative distance that the communication server uses when no other specification exists for a routing information source.
<i>address</i>	(Optional.) IP address.
<i>mask</i>	(Optional.) In dotted-decimal format which bits, if any, to ignore in the address value; a set bit 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.

Default

See values in Table 1-1

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 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 the “Examples” for further clarification).

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

Default administrative distances are shown in Table 1-1.

Table 1-1 Default Administrative Distance

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

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 AS 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
```

distribute-list (in)

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

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

Syntax Description

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

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

This command is used to filter by network numbers, not by AS paths.

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
```


distribute-list (out)

Use this form of the **distribute-list** router configuration command to suppress networks from being advertised in updates. Use the **no** form of this command to cancel this function.

```
distribute-list access-list-number out {interface-name | routing-process}  
no distribute-list access-list-number out {interface-name | routing-process}
```

Syntax Description

<i>access-list-number</i>	Standard IP access list number. The list explicitly specifies which networks are to be sent and which are to be suppressed in routing updates.
out	Applies the access list to outgoing routing updates.
<i>interface-name</i>	Name of a particular interface. Does not apply to OSPF.
<i>routing-process</i>	Name of a particular routing process, or static or connected .

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

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

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

Example

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

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

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. The **no ip address** command removes the specified secondary address.

```
ip address IP-address network-mask [secondary]  
no ip address IP- address network-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. Routers on an older, bridged segment can be easily made aware that there are many subnets on that segment.
- Two subnets of a single network might otherwise be separated by another network. This situation is not permitted when subnets are in use. In these instances, the first network is *extended*, or layered on top of the second network using secondary addresses.

Note If any 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 interface Ethernet 0.

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

ip as-path access-list

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

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

Syntax Description

<i>access-list-number</i>	Integer from 1 to 99 that indicates the access list.
permit	Permits access for matching conditions.
deny	Denies access to matching conditions.
<i>as-regular-expression</i>	AS in the access list using a regular expression. See the “Regular Expressions” appendix for information on forming regular expressions.

Default

None

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 AS path does not contain the local AS 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” 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 AS 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 default-network** 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.

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 gdp

Use any of the **ip gdp** interface configuration commands to enable GDP routing on an interface. The **no ip gdp** command disables GDP routing, with all default parameters.

```
ip gdp priority number  
ip gdp reporttime seconds  
ip gdp holdtime seconds  
no ip gdp
```

Syntax Description

priority <i>number</i>	Alters the GDP priority; default is a priority of 100. A larger number indicates a higher priority.
reporttime <i>seconds</i>	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>	Alters the GDP default hold time of 15 seconds.

Default

```
priority = 100  
reporttime = 5 seconds for broadcast media; 0 for nonbroadcast media  
holdtime = 15 seconds
```

Command Mode

Interface configuration

Usage Guidelines

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

Example

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

```
ip gdp reporttime 10
```


ip irdp

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

```

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

```

Syntax Description

multicast	Use the multicast address (224.0.0.1) instead of IP broadcasts.
holdtime <i>seconds</i>	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>	Maximum interval in seconds between advertisements. The default is 600 seconds.
minadvertinterval <i>seconds</i>	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>	Router'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>]	IP address (<i>address</i>) to proxy-advertise, and optionally, its preference value (<i>number</i>).

Default

When enabled, IRDP uses these defaults:

- Broadcast IRDP advertisements:
- Maximum interval between advertisements: 600 seconds
- Minimum interval between advertisements: 0.75 time **maxadvertinterval** seconds
- 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 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. The **no ip ospf authentication-key** command removes 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

Null

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

Use the **ip ospf cost** interface configuration command to explicitly specify the cost of sending a packet on an interface. The **no ip ospf cost** command resets the path cost for an interface to the default value.

```
ip ospf cost cost  
no ip cost
```

Syntax Description

cost Unsigned integer value expressed as the link state metric.
The range is from 1 to 65535.

Default

See “Usage Guidelines”

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 communication server 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:

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

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

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. The **no ip ospf dead-interval** command resets the length of time to the default value.

```
ip ospf dead-interval number-of-seconds  
no ip ospf dead-interval
```

Syntax Description

<i>number-of-seconds</i>	Unsigned integer value that specifies the interval; 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. The **no ip ospf hello-interval** command resets the interval to the default value.

```
ip ospf hello-interval number-of-seconds  
no ip ospf hello-interval
```

Syntax Description

<i>number-of-seconds</i>	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-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. The **no ip ospf-name-lookup** command disables 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     communication server 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     communication server 381      0x80000001 0xC117
```

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. The **no ip ospf network** command restores 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

neighbor (OSPF)
x25-map
frame-relay 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. The **no ip ospf priority** command resets the communication server priority to the default value.

```
ip ospf priority number  
no ip ospf priority
```

Syntax Description

<i>number</i>	8-bit unsigned integer that specifies the priority. The range is from 0 to 255.
---------------	---

Default

1

Command Mode

Interface configuration

Usage Guidelines

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

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

Example

The following example sets the 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. The **no ip ospf retransmit-interval** command resets the link state advertisement retransmission interval to the default value.

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

Syntax Description

<i>number-of-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 the acknowledgement. If it receives no acknowledgement in the amount of time specified by the *number-of-seconds* argument, 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. The **no ip ospf transmit-delay** command resets the estimated transmission time to the default value.

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

Syntax Description

<i>number-of-seconds</i>	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 *number-of-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 route

Use the **ip route** global configuration command to establish static routes. The **no ip route** command removes 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

None

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 using RIP, IGRP, and other dynamic routing protocols, regardless of whether **redistribute static** commands were specified for those routing protocols. These static routes will be advertised because static routes that point to an interface are considered to be connected in the routing table and hence lose their static nature. However, if you define a static route to an interface that is not in 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 via 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
```

keepalive

Use the **keepalive** interface configuration command to set the keepalive timer for a specific interface. The **no keepalive** command resets it to the keepalive default value.

keepalive [*seconds*]
no keepalive [*seconds*]

Syntax Description

seconds (Optional.) Unsigned integer value greater than 0. The default is 10 seconds.

Default

10 seconds

Command Mode

Interface configuration

Usage Guidelines

You can configure the keepalive interval, which is the frequency at which the communication server sends messages to itself (Ethernet and Token Ring) or to the other end (serial), to ensure a network interface is alive. The interval in previous software versions was 10 seconds; it is now adjustable in 1-second increments down to 1 second. An interface is declared down after three update intervals have passed without receiving a keepalive packet.

Setting the keepalive timer to a low value is very useful for rapidly detecting Ethernet interface failures (transceiver cable disconnecting, cable unterminated, and so on).

A typical serial line failure involves losing Carrier Detect (CD). Since this sort of failure is typically noticed within a few milliseconds, adjusting the keepalive timer for quicker routing recovery is generally not useful.

Note When adjusting the keepalive timer for a very low bandwidth serial interface, large datagrams can delay the smaller keepalive packets long enough to cause the line protocol to go down. You may need to experiment to determine the best value.

Example

The following example sets the keepalive interval to 3 seconds.

```
interface ethernet 0
  keepalive 3
```

Related Commands

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

encapsulation ppp †

frame-relay keepalive †

smds dxi †

match

See the **route-map** global configuration command.

metric holddown

Use the **no metric holddown** router configuration command to disable metric holddown (IGRP and RIP). Use the **metric holddown** command to reenable metric holddown once it is disabled.

no metric holddown
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.

This command assumes that the entire AS is running Cisco Version 8.2(5) or more recent software since the hop count is used to avoid information looping. Using it with earlier software will cause inconsistent routing behavior.

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 weights
metric maximum-hops
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 metric maximum-hops** command to reset the value to the default.

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

Syntax Description

hops Maximum hop count (in decimal). The default value is 100 hops; the maximum 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 AS 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 weights
metric holddown

metric weights

Use the **metric weights** router configuration command to allow the tuning of the IGRP metric calculations. Use the **no metric weights** 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

The default version of IGRP is $K1 = K3 = 1$, $K2 = K4 = K5 = 0$.

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:

$$\text{metric} = [K1 * \text{bandwidth} + (K2 * \text{bandwidth}) / (256 - \text{load}) + K3 * \text{delay}]$$

If $K5$ does not equal zero, an additional operation is done:

$$\text{metric} = \text{metric} * [K5 / (\text{reliability} + K4)]$$

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 FFFFFFFF (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 1-2 lists the default values used for several common media.

Table 1-2 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% 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

neighbor (EGP, BGP, IGRP, RIP)

Use the **neighbor** router configuration command to define a neighboring communication server with which to exchange routing information. Use the **no neighbor** 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

None

Command Mode

Router configuration

Usage Guidelines

For exterior routing protocols such as EGP and BGP, 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 interface Ethernet 1. However, in this case a **neighbor** router configuration command is included. This command permits the sending of routing updates to specific neighbors. One copy of the routing update is generated per neighbor.

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

Related Command

passive-interface

neighbor (OSPF)

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

Syntax Description

<i>ip-address</i>	Interface IP address of the neighbor.
priority <i>number</i>	(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 <i>number-of-seconds</i>	(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

Disabled

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 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 which are eligible to become designated communication servers (DR) and back-up designated communication servers (BDR). After DR and BDR are selected, DR and BDR will then start sending Hello packets to all neighbors in order to form adjacencies.

Example

The following example declares a 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 (configure-neighbors)

Use this form of the **neighbor** router configuration command to instruct the router to treat temporary neighbors which have been accepted by a template as if they had been configured by hand. The **no** form of the 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

Disabled

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 router configuration (**write terminal**).

When **configure-neighbors** is enabled on a particular template, any neighbor accepted by that template will be treated as if it had been manually configured. These neighbors will show up in **write terminal** displays and will be written to the non-volatile 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 who 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 this form of the **neighbor** 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

Disabled

Command Mode

Router configuration

Usage Guidelines

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

Example

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

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

Related Command

ip as-path access-list
neighbor (filter-list)

neighbor (ebgp-multihop)

Use this form of the **neighbor** 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 the command to return to the default of allowing only directly connected neighbors.

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

Syntax Description

<i>ip-address</i>	IP address of the BGP-speaking neighbor.
ebgp-multihop	Allow connections to or from external BGP neighbors residing on networks not directly connected to the communication server.

Default

None

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:

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

neighbor (filter-list)

Use this form of the **neighbor** 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 AS 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 matching communication servers. The default value is 32. Acceptable values are 1 to 255.

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

This command establishes filters on both inbound and outbound BGP routes. If a weight is assigned, the given weight is added to the weight of the communication server if the AS path matches the regular expression. 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.

This command applies to routes learned from the neighbor, not routes sent to the neighbor.

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 AS 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 Command

ip as-path access-list

neighbor (distribute-list)

neighbor (weight)

neighbor (neighbor-list)

Use this form of the **neighbor** router configuration command to configure BGP to support anonymous neighbor peerings 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 1-99.

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

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

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

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

You can use the **neighbor configure-neighbors** command to request that the 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 non-volatile 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 router will send them routing information. However, the distribute-list clause instructs the local router to ignore all information these remote BGP speakers send to it.

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

Related Commands

access-list (standard)

neighbor (configure-neighbors)

neighbor (ebgp-multihop)

neighbor (next-hop-self)

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

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

Syntax Description

<i>ip-address</i>	IP address of the BGP-speaking neighbor.
next-hop-self	Advertise local communication server as next hop.

Default

None

Command Mode

Router configuration

Usage Guidelines

This is useful in non-meshed 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 this form of the **neighbor** 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>	AS to which the neighbor belongs.

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

Specifying a neighbor with an AS number that matches the AS number specified in the **communication server bgp** global configuration command identifies the neighbor as internal to the local AS. 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 AS 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 AS 109, and two networks are listed as originating in the AS. Then the addresses of three remote communication servers (and their ASs) 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 AS; the second **neighbor** command illustrates specification of an internal neighbor (with the same AS 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 (third-party)

Use this form of the **neighbor** 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.
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 this form of the **neighbor** router configuration command to configure the communication server to allow internal BGP sessions even when the outbound interface goes down. The **no** form of this command restores 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

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

interface Loopback interface.

Default

best-local-address

Command Mode

Router configuration

Usage Guidelines

This feature works in conjunction with the Loopback interface feature described in the *Communication Server Configuration Guide*. This feature is especially useful when there is more than one internal path between routers and you want to be sure that the IBGP peering stays up all the time if some links in your backbone fail.

Example

In the following example, BGP TCP connections for the specified neighbor(s) 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 this form of the **neighbor** router configuration command to configure the communication server to accept only Version 2 of the BGP protocol and permit dynamic version negotiation with neighbors. The **no** form of this command returns 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.
version <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 3 of BGP and dynamically negotiate down to Version 2 if requested.

Default

Version 3

Command Mode

Router configuration

Usage Guidelines

Our implementation of BGP supports Versions 2 and 3 of the protocol and permits dynamic version negotiation with neighbors.

Example

The following example locks down to Version 2 of the BGP protocol.

```
router bgp 109
neighbor 131.104.27.2 version 2
```

neighbor (weight)

Use this form of the **neighbor** router configuration command to specify a weight to assign to a specific neighbor connection. The **no** form of this command removes 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 -65536 to 65535.

Default

Disabled

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.

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

Example

The following example increases by 50 the weight of all routes learned via 151.23.12.1.

```
router bgp 109  
neighbor 151.23.12.1 weight 50  
neighbor 151.23.12.1 filter-list 1 weight 10
```

Related Command

neighbor (distribute-list)

neighbor (filter-list)

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. The **no neighbor any** command removes the configuration.

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

Syntax Description

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

Default

Disabled

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. The **no neighbor any third-party** command removes 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

Disabled

Command Mode

Router configuration

Example

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

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

Related Commands

```
neighbor any  
router egp 0
```

network (BGP)

Use the **network** router configuration command to specify the BGP network to be advertised as originating within the current AS. The **no network** command removes the specified network.

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

Syntax Description

network-number IP address of the network.

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

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

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

Example

The following example sets up network 131.108.0.0 to be included in the communication server's BGP updates.

```
router bgp 120
network 131.108.0.0
```

Related Command

router bgp

network (backdoor)

Use this form of the **network** router configuration command to specify a backdoor route to a BGP border communication server that will provide better information about the network. The **no** form of this command removes 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

Disabled

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 (EGP)

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

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

Syntax Description

network-number IP address of a peer communication server with which routing information will be exchanged.

Default

Disabled

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 AS 164. It will advertise the networks 131.108.0.0 and 192.31.7.0 to the communication server in AS 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 (IGRP)

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

```
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 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 AS 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 (OSPF)

Use this form of the **network** router configuration command to define the interfaces on which OSPF runs and to define the area ID for those interfaces. The **no** form of this command disables 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*.

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 (RIP)

Use the **network** router configuration command to specify a list of networks for the RIP routing process. The **no network** command removes 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

Disabled

Command Mode

Router configuration

Usage Guidelines

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

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

Example

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

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

Related Command

router rip

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). The **no offset-list** command with the appropriate keywords removes 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

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. The **no passive-interface** command reenables sending routing updates on the specified interface.

passive-interface *interface*
no passive-interface *interface*

Syntax Description

<i>interface</i>	Specified interface. The particular subnet will continue to be advertised to other interfaces. Updates from other communication servers on that interface continue to be received and processed.
------------------	--

Default

Disabled

Command Mode

Router configuration

Usage Guidelines

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 interface Ethernet 1.

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


redistribute

Use the **redistribute** router configuration command to redistribute routes from one routing domain into another routing domain. The **no** form of this command ends redistribution of information when you supply the appropriate arguments, or disables any of the specified keywords.

```
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>	The source protocol from which routes are being redistributed. It can be one of the following keywords: bgp , egp , igrp , ospf , static [ip] , connected and rip . The keyword static [ip] is used to redistribute IP static routes. 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, these routes will be redistributed as external to the AS.
<i>process-id</i>	For bgp , egp , or igrp , this is an Autonomous System (AS) number, a 16-bit decimal number. 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.
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.

match internal external	(Optional.) For OSPF, the criteria by which OSPF routes are redistributed into other routing domains. It can be one of the following: internal: Routes that are internal to a specific AS. external 1: Routes that are external to the AS, but are imported into OSPF as Type 1 external routes. external 2: Routes that are external to the AS, but are imported into OSPF as Type 2 external routes.
external type-value	(Optional.) External route type to be redistributed into other routing domains: 1 —Type 1 external route 2 —Type 2 external route The default is internal.
tag tag-value	(Optional.) 32-bit decimal value attached to each external route. This is not used by the OSPF protocol itself. It may be used to communicate information between AS boundary communication servers. If none is specified, then the remote AS 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>	Identifier of a configured route map.
subnets	(Optional.) For redistributing routes into OSPF, the scope of redistribution for the specified protocol.

Default

See “Syntax Description” for the various defaults.

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 or reach the destination.

Redistributed routing information should always be filtered by the **distribute-list out** router configuration command. This ensures that only those routes intended by the administrator are passed along to the receiving routing protocol.

Whenever you use the **redistribute** or the **default-information** router configuration commands to redistribute routes into an OSPF routing domain, the communication server automatically becomes an AS boundary communication server. However, an AS boundary communication server does not, by default, generate a *default route* into the OSPF routing domain.

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.

When routes are redistributed into OSPF and *metric* is omitted, OSPF uses the default metric of 20 for routes from all protocols except BGP routes, which have a metric of 1.

Note The **metric** value specified in the **redistribute** command supersedes the **metric** value specified using the **default-metric** command.

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 illustrates the use of this form of the **redistribute** command, with the **match** keyword and its options enabled:

```
router igrp 108
 redistribute ospf 109 match internal external 1 external 2
```

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
```

Related Commands

default-information originate
distribute-list out
route-map
show route-map

route-map (including match and set route-map configuration commands)

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.

```
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	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	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>	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.

The match route-map configuration commands

The **match** route-map configuration command has multiple formats. Each format is shown below, described as separate commands. 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.

Use this form of the **match** command for any routes with address specified by a standard access list:

```
match ip address access-list-number [access-list-number...access-list-number]
no match ip address access-list-number [access-list-number...access-list-number]
```

Syntax Description

ip address Any routes with the network address passed by one or more of the standard access lists specified will be redistributed.

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

The access list number must be the number of a standard access list; that is, it must be a number from 1 through 99. Also, the access list that you specify must have a nonzero mask. If the mask is 0.0.0.0, the command will not match any route to the specified network for the route map. The following is an example of how to specify the **access-list** command:

```
access-list 30 permit 131.108.0.0 0.0.255.255
```

The following are incorrect ways of specify the preceding **access-list** command. This first command is incorrect because no mask is specified. The second command is incorrect because the mask is all zeros.

```
access-list 30 permit 131.108.0.0
```

```
access-list 30 permit 131.108.0.0 0.0.0.0
```

Use this form of the **match** command for any routes which have their next hop out one of the interfaces specified:

```
match interface name unit [name unit...name unit]
```

```
no match interface name unit [name unit...name unit]
```

Syntax Description

interface Any routes which have their next hop out one of the interfaces specified will be redistributed.

name unit Names of interfaces, such as Ethernet 0 or Serial 2.

Use this form of the **match** command for any routes with the metric specified:

```
match metric metric-value
```

```
no match metric metric-value
```

Syntax Description

metric Any routes with the metric specified will be redistributed.

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

Use this form of the **match** command for any routes which have a next-hop communication server address passed by one of the access lists specified:

```
match ip next-hop access-list-number [access-list-number...access-list-number]  
no match ip next-hop access-list-number [access-list-number...access-list-number]
```

Syntax Description

next-hop	Any routes which have a next-hop communication server address passed by one of the access lists specified will be redistributed.
<i>access-list-number</i>	One or more numeric identifiers of standard access lists.

Use this form of the **match** command for any routes which have been advertised by communication servers at the address specified by the access lists:

```
match ip route-source access-list-number [access-list-number...access-list-number]  
no match ip route-source access-list-number [access-list-number...access-list-number]
```

Syntax Description

route-source	Any routes which have been advertised by communication servers at the address specified by the access lists will be redistributed. There are situations in which a route's next hop and source communication server address may not be the same.
<i>access-list-number</i>	One or more numeric identifiers of access lists.

Use this form of the **match** command for any routes which are of the specified type:

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

Syntax Description

route-type	Any routes that are of the specified type will be redistributed.
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.

Use this form of the **match** command for any routes stored in the routing table with one of the tags specified:

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

Syntax Description

tag Any routes stored in the routing table with one of the tags specified will be redistributed.

tag-value List of one or more route tags.

The set route-map configuration commands

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.

Use this form of the **set** command to provide a mechanism to perform conditional route aggregation as well as conditional default route advertisements:

```
set ip destination access-list-number  
no set ip destination access-list-number
```

Syntax Description

destination Network to advertise instead of the one under consideration. This provides a mechanism to perform conditional route aggregation as well as conditional default route advertisements. There is no default value.

access-list-number Access list number (usually just one line long) that specifies the network to advertise.

Use this form of the **set** command for routes that are advertised into this specified area of the routing domain:

```
set level {stub-area | backbone}  
no set level {stub-area | backbone}
```

Syntax Description

level Redistributed routes are advertised into this specified area of the routing domain.

stub-area Inserted into OSPF Not So Stubby Areas (NSSA).

backbone Inserted into OSPF as External LSAs.

Use this form of the **set** command to set the metric value to give the redistributed routes:

set metric *metric-value*
no set metric *metric-value*

Syntax Description

metric Metric value to give the redistributed routes. There is no default value

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

Use this form of the **set** command to set the metric type to give redistributed routes:

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

Syntax Description

metric-type Metric type to give redistributed routes. There is no default value.

type-1 OSPF Type 1 metric.

type-2 OSPF Type 2 metric.

Use this form of the **set** command to set a tag value to associate with the redistributed routes.

set tag *tag-value*
no set tag *tag-value*

Syntax Description

tag Tag value to associate with the redistributed route. If not specified, the default action is to *forward* the tag in the source routing protocol onto the new destination protocol.

tag-value Name for the tag.

Default

Disabled

Command Mode

route-map: global configuration

match and **set**: route-map configuration

Usage Guidelines

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 **communication server** 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.

Example

The following example redistributes all OSPF routes into IGRP:

```
router igrp 109
 redistribute ospf 110
```

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 type1 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 Command

redistribute
show route-map

router bgp

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

None

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 AS 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. To turn off the EGP routing process, use the **no router egp** command.

```
router egp remote-AS  
no router egp remote-AS
```

Syntax Description

<i>remote-AS</i>	Identifies the autonomous system (AS) number the communication server expects its peers to be advertising in their EGP messages.
------------------	--

Default

None

Command Mode

Global configuration

Usage Guidelines

You must specify the autonomous system number before starting EGP. The local AS number will be included in EGP messages sent by the communication server. The software does not insist that the actual remote AS number match the configured AS numbers. The output from the **debug ip-egp EXEC** command will advise of any discrepancies.

Example

The following example assigns a communication server to AS 109 and is peering with communication servers in AS 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 router egp 0** 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 AS. Because all neighbors are in the same AS, 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 ASs, 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 igrp

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

```
router igrp autonomous-system  
no router igrp autonomous-system
```

Syntax Description

<i>autonomous-system</i>	Identifies the routes to the other IGRP communication servers and is used to tag the routing information.
--------------------------	---

Default

None

Command Mode

Global configuration

Example

The following example shows how to configure an IGRP routing process and assign AS 109.

```
router igrp 109
```

Related Command

network (IGRP)

router ospf

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

router ospf *ospf-process-id*
no router ospf *ospf-process-id*

Syntax Description

<i>ospf-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

Disabled

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. Turn off the RIP routing process using the **no router rip** command.

```
router rip  
no router rip
```

Syntax Description

This command has no arguments or keywords.

Default

None

Command Mode

Global configuration

Example

The following example shows how to begin the RIP routing process.

```
router rip
```

Related Command

network (RIP)

set

set

See the **route-map** global configuration command.

show ip bgp

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

```
show ip bgp [network]
```

Syntax Description

network (Optional.) Network number, entered to display a particular network in the BGP routing table.

Command Mode

EXEC

Sample Display

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

```
cs# show ip bgp

BGP table version is 11485, local communication server ID is 192.54.222.2
Status codes: * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

Network          Next Hop        Metric  Weight    Path
*> 128.128.0.0   131.192.115.3          0         ?
*> 192.132.70.0  192.54.222.9          20        702 701 ?
*> 152.155.0.0   131.192.4.2           0         ?
*> 192.52.247.0  131.192.77.2          0         ?
*> 192.74.137.0  192.54.222.92         0        702 701 i
*> 192.139.79.0  192.54.222.92         0        702 701 ?
*> 146.150.0.0   131.192.4.2           0         ?
*> 192.75.142.0  192.54.222.92         0        702 701 ?
*> 192.75.141.0  192.54.222.92         0        702 701 ?
*> 142.136.0.0   192.54.222.92         0        702 701 ?
*> 192.139.77.0  192.54.222.92         0        702 701 ?
```

Table 1-3 describes significant fields shown in the display.

Table 1-3 Show IP BGP Field Descriptions

Field	Description
BGP table version is 11485	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.
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.

Field	Description
Metric	If shown, is the value of the interautonomous system metric. This is frequently not used.
Weight	Set through the use of AS 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

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. Use the optional form **show ip bgp neighbors address routes** to show the routes learned from a particular neighbor.

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

Syntax Description

address (Optional.) Address of the neighbor whose routes you have learned from.

routes (Optional.) Routes of specified neighbors.

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 1-4 describes significant fields shown in the display.

Table 1-4 Show IP BGP Neighbors Field Descriptions

Field	Description
BGP neighbor	Lists the IP address of the BGP neighbor and its AS number. If the neighbor is in the same AS 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.

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 1-5 describes significant fields shown in the display.

Table 1-5 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 INTER_AS metric for the path. This metric is only sent to external peers, not to internal peers.
Path	The AS_PATH for that route, followed by the origin code for that route.

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 3937, main routing table version 3937

Neighbor      V    AS  MsgRcvd  MsgSent  TblVer  InQ  OutQ  Uptime/State
192.54.222.6  2   690    7655     268    3937   0    0  2:39:51
192.54.222.9  3   702     682     364    3937   0    0  2:39:54
```

Table 1-6 describes significant fields shown in the display.

Table 1-6 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.
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 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 1-7 describes the fields shown in the display.

Table 1-7 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 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 ospf

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

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

Syntax Description

ospf-process-id (Optional.) Specific 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 communication server
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 1-8 describes significant fields shown in the display.

Table 1-8 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 AS 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 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 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.

Syntax for the various forms of the **show ip ospf database** command follow.

```

show ip ospf [ospf-process-id area-id] database
show ip ospf [ospf-process-id area-id] database [communication server] [link-state-id]
show ip ospf [ospf-process-id area-id] database [network] [link-state-id]
show ip ospf [ospf-process-id area-id] database [summary] [link-state-id]
show ip ospf [ospf-process-id area-id] database [asb-summary] [link-state-id]
show ip ospf [ospf-process-id] database [external] [link-state-id]

```

Command Mode

EXEC

Syntax Description

<i>ospf-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 *link-state-id* can take one of two forms:

- The network's IP address (as in type 3 summary link advertisements and in AS 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 AS 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 1-9 describes significant fields shown in the display.

Table 1-9 Show IP OSPF Database Field Descriptions

Field	Description
Link ID	Router ID number.
ADV Router	Advertising communication server’s communication server 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 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 1-10 describes significant fields shown in the display.

Table 1-10 Show IP OSPF Database Asb-Summary Field Descriptions

Field	Description
Router ID	Router ID number.
Autonomous system	OSPF autonomous system number (OSPF process ID).
LS age	Link state age.
Options	Type of Service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID (AS Boundary Router).
Advertising Router	Advertising communication server's communication server 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 1-11 describes significant fields shown in the display.

Table 1-11 Show IP OSPF Database External Field Descriptions

Field	Description
Router ID	Router ID number.
Autonomous system	OSPF autonomous system number (OSPF process ID).
LS age	Link state age.
Options	Type of Service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID (External Network Number).
Advertising Router	Advertising communication server's communication server ID.
LS Seq Number	Link state sequence number (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
Network Mask	Network mask implemented.
Metric Type	External Type.
TOS	Type of Service.
Metric	Link state metric.
Forward Address	Forwarding address. Data traffic for the advertised destination will be forwarded to this address. If the forwarding address is set to 0.0.0.0, data traffic will be forwarded instead to the advertisement's originator.
External Route Tag	External route tag, a 32-bit field attached to each external route. This is not used by the OSPF protocol itself.

Sample Display Using Show Ip Ospf Database Network

The following is sample output from the **show ip ospf database network** command 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
    Attached Router: 155.187.1.2
    Attached Router: 155.187.21.5

```

Table 1-12 describes significant fields shown in the display.

Table 1-12 Show IP OSPF Database Network Field Descriptions

Field	Description
OSPF Router with ID(190.20.239.66)	Router ID number.
Autonomous system 300	OSPF autonomous system number (OSPF process ID).
LS age: 1367	Link state age.
Options: (No TOS-capability)	Type of Service options (Type 0 only).
LS Type: Network Links	Link state type.
Link State ID	Link state ID of designated communication server.
Advertising Router	Advertising communication server's communication server 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 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 communication server

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 1-13 describes significant fields shown in the display.

Table 1-13 Show IP OSPF Database Router Field Descriptions

Field	Description
Router ID	Router ID number.
Autonomous system	OSPF autonomous system number (OSPF process ID).
LS age	Link state age.
Options	Type of Service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID.
Advertising Router	Advertising communication server's communication server 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	Router interface address.
TOS	Type of Service metric (Type 0 only).

Sample Display Using Show Ip Ospf Database Summary

The following is sample output from **show ip ospf database summary** command 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 1-14 describes significant fields shown in the display.

Table 1-14 Show IP OSPF Database Summary Field Descriptions

Field	Description
Router ID	Router ID number.
Autonomous system	OSPF autonomous system number (OSPF process ID).
LS age	Link state age.
Options	Type of Service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID (summary network number).
Advertising Router	Advertising communication server's communication server ID.
LS Seq Number	Link state sequence (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
Network Mask	Network mask implemented.
TOS	Type of Service.
Metric	Link state metric.

show ip ospf interface

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

```
show ip ospf interface [interface-name]
```

Syntax Description

interface-name (Optional.) Formed either as the one-word interface description (for example, serial0 or ethernet0), or as the two-word interface-type unit-number specification (for example, serial 0, ethernet 1, or e 2).

Command Mode

EXEC

Sample Display

The following is sample output from the **show ip ospf interface** command when the 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 1-15 describes significant fields shown in the display.

Table 1-15 Show IP OSPF Interface Ethernet 0 Field Descriptions

Field	Description
Ethernet	Status of physical link and operational status of protocol.
Internet Address	Interface IP address, subnet mask, and area address.
AS	AS 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 communication server	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 [interface-name] [neighbor-id]
```

Syntax Description

interface-name (Optional.) Formed either as the one-word interface description (for example, serial0 or ethernet0), or as the two-word interface-type unit-number specification (for example, serial 0, ethernet 1, or e 2).

neighbor-id (Optional.) Neighbor ID.

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
```

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
```

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 e 0 199.199.199.137
Neighbor 199.199.199.137, interface address 160.89.80.37
  In the area 0.0.0.0 via interface Ethernet0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 0:00:37
  Link State retransmission due in 0:00:04
```

You can also specify the interface without the Neighbor ID to show all neighbors on the specified interface, as in the following sample display:

```
cs# show ip ospf neighbor f 0

      ID          Pri   State          Dead Time      Address        Interface
192.31.48.1      1    FULL/DROTHER  0:00:33      192.31.48.1   Ethernet0
```

Table 1-16 describes significant fields shown in the previous display.

Table 1-16 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	Router priority of neighbor, neighbor state.
State	OSPF state.
Options	Hello packet options field contents (E-bit only; possible values are 0 and 2; 2 indicates area is not a stub; 0 indicates area is a stub.
Dead timer	Expected time before 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 1-17 describes significant fields shown in the display.

Table 1-17 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 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 process:

```
cs# show ip protocols

Routing Protocol is "igrp 109"
  Sending updates every 90 seconds, next due in 88 seconds
  Invalid after 270 seconds, hold down for 280, flushed after 630
  Outgoing update filter list for all routes is not set
  Incoming update filter list for all routes 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
  Redistributing: igrp 109
  Routing for Networks:
    131.108.0.0
    192.31.7.0
  Routing Information Sources:
    Gateway         Distance   Last Update
    131.108.2.201   100       0:00:08
    131.108.200.2   100       5d15
    131.108.2.200   100       0:00:09
    131.108.2.203   100       0:00:11
```

Table 1-18 describes significant fields shown in the display.

Table 1-18 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 [address [mask]] | [protocol [process-id]]
```

Syntax Description

<i>address</i>	(Optional.) Address about which routing information should be displayed.
<i>mask</i>	(Optional.) Argument for a subnet mask.
<i>protocol</i>	(Optional.) Argument for a particular routing protocol, or static or connected .
<i>process-id</i>	(Optional.) Identifies 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 E0 150.150.0.0 [160/5] via 131.119.254.6, 0:01:00, Ethernet0
E    192.67.131.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet0
O E0 192.68.132.0 [160/5] via 131.119.254.6, 0:00:59, Ethernet0
O E0 130.130.0.0 [160/5] via 131.119.254.6, 0:00:59, Ethernet0
E    128.128.0.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet0
E    129.129.0.0 [200/129] via 131.119.254.240, 0:02:22, Ethernet0
E    192.65.129.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet0
E    131.131.0.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet0
E    192.75.139.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet0
E    192.16.208.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet0
E    192.84.148.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet0
E    192.31.223.0 [200/128] via 131.119.254.244, 0:02:22, Ethernet0
E    192.44.236.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet0
E    140.141.0.0 [200/129] via 131.119.254.240, 0:02:22, Ethernet0
E    141.140.0.0 [200/129] via 131.119.254.240, 0:02:23, Ethernet0
```

Table 1-19 describes significant fields shown in this display.

Table 1-19 Show IP Route Field Descriptions

Field	Description
O	Indicates protocol that derived the route. Possible values include: <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: <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.
*	Round-robin pointer. It indicates the last path used when a packet was forwarded. The pointer applies to nonfast-switched packets only. The asterisk gives no indication as to which path will be used next when forwarding a nonfast-switched packet except when the paths are of 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 1-20 describes significant fields shown in the display.

Table 1-20 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          0          0          360
Total          751       17         32130     92160
cs#
```

Table 1-21 describes the fields shown in the display:

Table 1-21 Show IP Route Summary Field Descriptions

Field	Description
Route Source	Routing protocol name, or connected or 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 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 1-22 describes the fields shown in the display:

Table 1-22 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. The **no synchronization** command enables 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 AS to have the route before BGP makes it available to other ASs.

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

Example

The following example disables route synchronization.

```
router bgp 120
no synchronization
```

timers basic (EGP, RIP, IGRP)

Use the **timers basic** router configuration command to adjust EGP, RIP, or IGRP network timers. The **no timers basic** command restores 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. The **no timers bgp** command resets 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. The **no timers egp** command resets the EGP timing defaults.

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

Syntax Description

<i>hello</i>	Frequency, in seconds, with which the communication server sends Hello messages to its peer. The default is 60 seconds.
<i>polltime</i>	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 the 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 router to only divide traffic among the routes with the best metric. Other routes will remain in the routing table, but will receive no traffic.

Example

In the following example, only routes of minimum cost will be used:

```
router igrp 5  
  traffic-share min
```

variance

Use the **variance** router configuration command to control load balancing in an IGRP-based internet. The **no variance** command resets variance to the default value.

variance *multiplier*
no variance

Syntax Description

multiplier Range of metric values that will be accepted for load balancing. Acceptable values are nonzero, positive integers. Default is 1.

Default

1, or 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
```

