



OSPF Commands

Use the commands in this chapter to configure and monitor the Open Shortest Path First (OSPF) routing protocol. For OSPF configuration information and examples, refer to the “Configuring OSPF” chapter of the *Network Protocols Configuration Guide, Part 1*.

area authentication

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

area *area-id* **authentication** [**message-digest**]

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

no area *area-id*

Syntax Description

<i>area-id</i>	Identifier of the area for which authentication is to be enabled. The identifier can be specified as either a decimal value or an IP address.
message-digest	(Optional) Enables MD5 authentication on the area specified by <i>area-id</i> .

Defaults

Type 0 authentication (no authentication)

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.
11.0	The message-digest keyword was added.

Usage Guidelines

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

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

If you enable MD5 authentication with the **message-digest** keyword, you must configure a password with the **ip ospf message-digest-key** command.

To remove the area's authentication specification, use the **no** form of this command with the **authentication** keyword.



Note

To remove the specified area from the software configuration, use the command **no area** *area-id* (with no other keywords). That is, **no area** *area-id* removes all area options, such as **area authentication**, **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

Examples

The following example mandates authentication for areas 0 and 10.0.0.0 of OSPF routing process 201. Authentication keys are also provided.

```
interface ethernet 0
 ip address 192.168.251.201 255.255.255.0
 ip ospf authentication-key abcdefgh
!
interface ethernet 1
 ip address 10.56.0.201 255.255.0.0
 ip ospf authentication-key ijklmnop
!
router ospf 201
 network 10.0.0.0 0.255.255.255 area 10.0.0.0
 network 192.168.0.0 0.0.255.255 area 0
 area 10.0.0.0 authentication
 area 0 authentication
```

Related Commands

Command	Description
area default-cost	Specifies a cost for the default summary route sent into a stub area.
area stub	Defines an area as a stub area.
ip ospf authentication	Assigns a password to be used by neighboring routers that are using the simple password authentication of OSPF.
ip ospf message-digest-key	Enables OSPF MD5 authentication.

area default-cost

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

area *area-id* **default-cost** *cost*

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

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

Defaults	
	<i>cost</i> : 1

Command Modes	
	Router configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

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

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



Note

To remove the specified area from the software configuration, use the command **no area** *area-id* (with no other keywords). That is, **no area** *area-id* removes all area options, such as **area authentication**, **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

Examples

The following example assigns a default-cost of 20 to stub network 10.10.0.0/24:

```
interface ethernet 0
 ip address 10.56.0.201 255.255.0.0
 !
router ospf 201
 network 10.0.0.0 0.255.255.255 area 10.0.0.0
 area 10.0.0.0 stub
 area 10.0.0.0 default-cost 20
```

Related Commands

Command	Description
area authentication	Enables authentication for an OSPF area.
area stub	Defines an area as a stub area.

area nssa

To configure an area as a not so stubby area (NSSA), use the **area nssa** command in router configuration mode. To remove the nssa distinction from the area, use the **no** form of this command.

```
area area-id nssa [no-redistribution] [default-information-originate [metric] [metric-type]]
    [no-summary]
```

```
no area area-id nssa
```

```
no area area-id
```

Syntax Description

<i>area-id</i>	Identifier of the area for which authentication is to be enabled. The identifier can be specified as either a decimal value or an IP address.
no-redistribution	(Optional) Used when the router is a NSSA ABR and you want the redistribute command to import routes only into the normal areas, but not into the NSSA area.
default-information-originate	(Optional) Used to generate a Type 7 default into the NSSA area. This argument takes effect on only NSSA ABR.
metric	OSPF default metric.
metric-type	OSPF metric type for default routes.
no-summary	(Optional) Allows an area to be a not-so-stubby area but not have summary routes injected into it.

Defaults

No NSSA area is defined.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines



Note

To remove the specified area from the software configuration, use the command **no area *area-id*** (with no other keywords). That is, **no area *area-id*** removes all area options, such as **area authentication**, **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

Examples

The following example enables NSSA authentication on area 1:

```
router ospf1
 redistribute rip subnets
 network 172.19.92.0.0.0.0.255 area 1
 area 1 nssa
```

area range

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

area *area-id* **range** *address mask* [**advertise** | **not-advertise**]

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

no area *area-id*

Syntax Description

<i>area-id</i>	Identifier of the area about which routes are to be summarized. It can be specified as either a decimal value or as an IP address.
<i>address</i>	IP address.
<i>mask</i>	IP mask.
advertise	(Default) Sets the address range status to advertise and generates a Type 3 summary LSA.
not-advertise	Sets the address range status to DoNotAdvertise. The Type 3 summary LSA is suppressed and the component networks remain hidden from other networks.

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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



Note

To remove the specified area from the software configuration, use the command **no area** *area-id* (with no other keywords). That is, **no area** *area-id* removes all area options, such as **area authentication**, **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

Examples

The following example specifies one summary route to be advertised by the ABR to other areas for all subnets on network 10.0.0.0 and for all hosts on network 192.168.110.0:

```
interface ethernet 0
 ip address 192.168.110.201 255.255.255.0
!
interface ethernet 1
 ip address 10.56.0.201 255.255.0.0
!
router ospf 201
 network 10.0.0.0 0.255.255.255 area 10.0.0.0
 network 192.168.110.0 0.0.0.255 area 0
 area 10.0.0.0 range 10.0.0.0 255.0.0.0
 area 0 range 192.168.110.0 255.255.255.0
```

area stub

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

area *area-id* **stub** [**no-summary**]

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

no area *area-id*

Syntax Description		
	<i>area-id</i>	Identifier for the stub area; either a decimal value or an IP address.
	no-summary	(Optional) Prevents an ABR from sending summary link advertisements into the stub area.

Defaults No stub area is defined.

Command Modes Router configuration

Command History	Release	Modification
	10.0	This command was introduced.

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

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

To further reduce the number of link state advertisements (LSAs) sent into a stub area, you can configure **no-summary** on the ABR to prevent it from sending summary LSAs (LSA type 3) into the stub area.



Note

To remove the specified area from the software configuration, use the command **no area** *area-id* (with no other keywords). That is, **no area** *area-id* removes all area options, such as **area authentication**, **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

Examples

The following example assigns a default cost of 20 to stub network 10.0.0.0:

```
interface ethernet 0
 ip address 10.56.0.201 255.255.0.0
!
router ospf 201
 network 10.0.0.0 0.255.255.255 area 10.0.0.0
 area 10.0.0.0 stub
 area 10.0.0.0 default-cost 20
```

Related Commands

Command	Description
area authentication	Enables authentication for an OSPF area.
area default-cost	Specifies a cost for the default summary route sent into a stub area.

area virtual-link

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

```
area area-id virtual-link router-id [authentication [message-digest | null]] [hello-interval
seconds] [retransmit-interval seconds] [transmit-delay seconds] [dead-interval seconds]
[[authentication-key key] | [message-digest-key keyid md5 key]]
```

```
no area area-id virtual-link router-id [authentication [message-digest | null]] [hello-interval
seconds] [retransmit-interval seconds] [transmit-delay seconds] [dead-interval seconds]
[[authentication-key key] | [message-digest-key keyid md5 key]]
```

```
no area area-id
```

Syntax Description		
<i>area-id</i>		Area ID assigned to the transit area for the virtual link. This can be either a decimal value or a valid IP address. There is no default.
<i>router-id</i>		Router ID associated with the virtual link neighbor. The router ID appears in the show ip ospf display. It is internally derived by each router from the router's interface IP addresses. This value must be entered in the format of an IP address. There is no default.
authentication		(Optional) Specifies authentication type.
message-digest		(Optional) Specifies that message-digest authentication is used.
null		(Optional) No authentication is used. Overrides password or message-digest authentication if configured for the area.
hello-interval <i>seconds</i>		(Optional) Time in seconds between the hello packets that the Cisco IOS software sends on an interface. Unsigned integer value to be advertised in the software's hello packets. The value must be the same for all routers and access servers attached to a common network. The default is 10 seconds.
retransmit-interval <i>seconds</i>		(Optional) Time in seconds between link state advertisement retransmissions for adjacencies belonging to the interface. Expected round-trip delay between any two routers on the attached network. The value must be greater than the expected round-trip delay. The default is 5 seconds.
transmit-delay <i>seconds</i>		(Optional) Estimated time in seconds required to transmit a link state update packet on the interface. 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 <i>seconds</i>		(Optional) Time in seconds that hello packets are not received before its neighbors declare the router down. Unsigned integer value. The default is four times the hello interval, or 40 seconds. As with the hello interval, this value must be the same for all routers and access servers attached to a common network.

authentication-key <i>key</i>	(Optional) Password to be used by neighboring routers. Any continuous string of characters that you can enter from the keyboard up to 8 bytes long. This string acts as a key that will allow the authentication procedure to generate or verify the authentication field in the OSPF header. This key is inserted directly into the OSPF header when originating routing protocol packets. A separate password can be assigned to each network on a per-interface basis. All neighboring routers on the same network must have the same password to be able to route OSPF traffic. The password is encrypted in the configuration file if the service password-encryption command is enabled. There is no default value.
message-digest-key <i>keyid</i> md5 <i>key</i>	(Optional) Key identifier and password to be used by neighboring routers and this router for MD5 authentication. The <i>key-id</i> is a number in the range 1 to 255. The <i>key</i> is an alphanumeric string of up to 16 characters. All neighboring routers on the same network must have the same key identifier and key to be able to route OSPF traffic. There is no default value.

Defaults

area-id: No area ID is predefined.
router-id: No router ID is predefined.
hello-interval *seconds:* 10 seconds
retransmit-interval *seconds:* 5 seconds
transmit-delay *seconds:* 1 second
dead-interval *seconds:* 40 seconds
authentication-key *key:* No key is predefined.
message-digest-key *key-id* **md5** *key:* No key is predefined.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.
11.0	The following keywords and arguments were added: <ul style="list-style-type: none"> message-digest-key <i>key-id</i> md5 <i>key</i>

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.

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

The two authentication schemes, simple text and MD5 authentication, are mutually exclusive. You can specify one or the other or neither. Any keywords and arguments you specify after **authentication-key *key*** or **message-digest-key *key-id* md5 *key*** are ignored. Therefore, specify any optional arguments before such a keyword-argument combination.

**Note**

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

**Note**

To remove the specified area from the software configuration, use the command **no area *area-id*** (with no other keywords). That is, **no area *area-id*** removes all area options, such as **area authentication**, **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

Examples

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

```
router ospf 201
 network 10.0.0.0 0.255.255.255 area 10.0.0.0
 area 10.0.0.0 virtual-link 10.3.4.5
```

The following example establishes a virtual link with MD5 authentication:

```
router ospf 201
 network 10.0.0.0 0.255.255.255 area 10.0.0.0
 area 10.0.0.0 virtual-link 10.3.4.5 message-digest-key 3 md5 sa5721bk47
```

Related Commands

Command	Description
area authentication	Enables authentication for an OSPF area.
service password-encryption	Encrypts passwords.
show ip ospf	Displays general information about OSPF routing processes.

auto-cost

To control how OSPF calculates default metrics for the interface, use the **auto-cost** command in router configuration mode. To assign cost based only on the interface type, use the **no** form of this command.

auto-cost reference-bandwidth *ref-bw*

no auto-cost reference-bandwidth

Syntax Description	reference-bandwidth <i>ref-bw</i> Rate in megabits per second (bandwidth). The range is 1 to 4294967; the default is 100.
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Defaults	100 megabits per second
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Command Modes	Router configuration
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Command History	Release	Modification
	11.2	This command was introduced.

Usage Guidelines In Cisco IOS Release 10.3 and later, by default OSPF will calculate the OSPF metric for an interface according to the bandwidth of the interface. For example, a 64K link will get a metric of 1562, and a T1 link will have a metric of 64.

The OSPF metric is calculated as *ref-bw* divided by *bandwidth*, with *ref-bw* equal to 10⁸ by default, and *bandwidth* determined by the **bandwidth** command. The calculation gives FDDI a metric of 1.

If you have multiple links with high bandwidth (such as FDDI or ATM), you might want to use a larger number to differentiate the cost on those links.

The value set by the **ip ospf cost** command overrides the cost resulting from the **auto-cost** command.

Examples The following example changes the cost of the FDDI link to 10, while the gigabit Ethernet link remains at a cost of 1. Thus, the link costs are differentiated.

```
router ospf 1
 auto-cost reference-bandwidth 1000
```

Related Commands	Command	Description
	ip ospf cost	Explicitly specifies the cost of sending a packet on an interface.

clear ip ospf

To clear redistribution based on the OSPF routing process ID, use the **clear ip ospf** command in privileged EXEC mode.

```
clear ip ospf [pid] {process | redistribution | counters [neighbor [intf] [nbr-id]]}
```

Syntax Description		
	<i>pid</i>	(Optional) Process ID.
	process	Reset OSPF process.
	redistribution	Clear OSPF route redistribution.
	counters	OSPF counters.
	neighbor	(Optional) Neighbor statistics per interface.
	<i>intf</i>	(Optional) Neighbor interface.
	<i>nbr-id</i>	(Optional) Neighbor ID.

Command Modes Privileged EXEC

Command History	Release	Modification
	11.1	This command was introduced.

Usage Guidelines Use the *pid* option to clear only one OSPF process. If the *pid* option is not specified, all OSPF processes are cleared.

Examples The following example clears all OSPF processes:

```
clear ip ospf process
!
```

compatible rfc1583

To restore the method used to calculate summary route costs per RFC 1583, use the **compatible rfc1583** command in router configuration mode. To disable RFC 1583 compatibility, use the **no** form of this command.

compatible rfc1583

no compatible rfc1583

Syntax Description This command has no arguments or keywords.

Defaults Compatible with RFC 1583.

Command Modes Router configuration

Release	Modification
12.1 (2)T	This command was introduced.

Usage Guidelines To minimize the chance of routing loops, all OSPF routers in an OSPF routing domain should have RFC compatibility set identically.

Because of the introduction of RFC 2328, *OSPF Version 2*, the method used to calculate summary route costs has changed. Use the **no compatible rfc1583** command to enable the calculation method used per RFC 2328.

Examples The following example specifies that the router process is compatible with RFC 1583:

```
router ospf 1
  compatible rfc1583
!
```

default-information originate (OSPF)

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

default-information originate [**always**] [**metric** *metric-value*] [**metric-type** *type-value*]
{**level-1** | **level-1-2** | **level-2**} [**route-map** *map-name*]

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

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

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

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

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

Examples

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

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

Related Commands

Command	Description
redistribute (IP)	Redistributes routes from one routing domain into another routing domain.

default-metric (OSPF)

To set default metric values for the OSPF routing protocol, use this form of the **default-metric** command in router configuration mode. To return to the default state, use the **no** form of this command.

default-metric *number*

no default-metric *number*

Syntax Description	<i>number</i>	Default metric value appropriate for the specified routing protocol.
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Defaults	Built-in, automatic metric translations, as appropriate for each routing protocol. The metric of redistributed connected and static routes is set to 0.
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Command Modes	Router configuration
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Command History	Release	Modification
	10.0	This command was introduced.

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

When enabled, the **default-metric** command applies a metric value of 0 to redistributed connected routes. The **default-metric** command does not override metric values that are applied with the **redistribute** command.

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

Related Commands	Command	Description
	redistribute (IP)	Redistributes routes from one routing domain into another routing domain.

distance ospf

To define OSPF route administrative distances based on route type, use the **distance ospf** command in router configuration mode. To restore the default value, use the **no** form of this command.

```
distance ospf {[intra-area dist1] [inter-area dist2] [external dist3]}
```

```
no distance ospf
```

Syntax Description

intra-area <i>dist1</i>	(Optional) Sets the distance for all routes within an area. The default value is 110.
inter-area <i>dist2</i>	(Optional) Sets the distance for all routes from one area to another area. The default value is 110.
external <i>dist3</i>	(Optional) Sets the distance for routes from other routing domains, learned by redistribution. The default value is 110.

Defaults

dist1: 110

dist2: 110

dist3: 110

Command Modes

Router configuration

Command History

Release	Modification
11.1(14)	This command was introduced.

Usage Guidelines

You must specify at least one of the keyword/argument pairs.

This command performs the same function as the **distance** command used with an access list. However, the **distance ospf** command allows you to set a distance for an entire group of routes, rather than a specific route that passes an access list.

A common reason to use the **distance ospf** command is when you have multiple OSPF processes with mutual redistribution, and you want to prefer internal routes from one over external routes from the other.

Examples

The following example changes the external distance to 200, making the route less reliable.

Router A

```
router ospf 1
 redistribute ospf 2 subnet
 distance ospf external 200
!
router ospf 2
 redistribute ospf 1 subnet
 distance ospf external 200
```

Router B

```
router ospf 1
 redistribute ospf 2 subnet
 distance ospf external 200
!
router ospf 2
 redistribute ospf 1 subnet
 distance ospf external 200
```

Related Commands

Command	Description
distance (IP)	Defines an administrative distance.

ip ospf authentication

To specify the authentication type for an interface, use the **ip ospf authentication** command in interface configuration mode. To remove the authentication type for an interface, use the **no** form of this command.

ip ospf authentication [message-digest | null]

no ip ospf authentication

Syntax Description	message-digest	(Optional) Specifies that message-digest authentication will be used.
	null	(Optional) No authentication is used. Useful for overriding password or message-digest authentication if configured for an area.

Defaults The area default is no authentication (null authentication).

Command Modes Interface configuration

Command History	Release	Modification
	12.0	This command was introduced.

Usage Guidelines Before using the **ip ospf authentication** command, configure a password for the interface using the **ip ospf authentication-key** command. If you use the **ip ospf authentication message-digest** command, configure the message-digest key for the interface with the **ip ospf message-digest-key** command.

For backward compatibility, authentication type for an area is still supported. If the authentication type is not specified for an interface, the authentication type for the area will be used (the area default is null authentication).

Examples The following example enables message digest authentication:

```
ip ospf authentication message-digest
```

Related Commands	Command	Description
	area authentication	Enables authentication for an OSPF area.
	ip ospf authentication-key	Assigns a password to be used by neighboring routers that are using the simple password authentication of OSPF.
	ip ospf message-digest-key	Enables OSPF MD5 authentication.

ip ospf authentication-key

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

ip ospf authentication-key *password*

no ip ospf authentication-key

Syntax Description	<i>password</i>	Any continuous string of characters that can be entered from the keyboard up to 8 bytes in length.
---------------------------	-----------------	--

Defaults	No password is specified.
-----------------	---------------------------

Command Modes	Interface configuration
----------------------	-------------------------

Command History	Release	Modification
	10.0	This command was introduced.

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



Note

The Cisco IOS software will use this key only when authentication is enabled for an area with the **area authentication** router configuration command.

Examples	The following example enables the authentication key with the string yourpass:
-----------------	--

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

Related Commands	Command	Description
	area authentication	Enables authentication for an OSPF area.

ip ospf cost

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

ip ospf cost *cost*

no ip ospf cost

Syntax Description	<i>cost</i>	Unsigned integer value expressed as the link state metric. It can be a value in the range 1 to 65535.
---------------------------	-------------	---

Defaults	No default cost is predefined.
-----------------	--------------------------------

Command Modes	Interface configuration
----------------------	-------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

You can set the metric manually using this command, if you need to change the default. Using the **bandwidth** command changes the link cost as long as this command is not used.

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

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

$$10^8 \div \textit{Bandwidth}$$

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

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

Examples

The following example sets the interface cost value to 65:

```
ip ospf cost 65
```

ip ospf database-filter

To filter outgoing LSAs to an OSPF interface, use the **ip ospf database-filter** command in interface configuration mode. To restore the forwarding of LSAs to the interface, use the **no** form of this command.

ip ospf database-filter all out

no ip ospf database-filter all out

Syntax Description

This command has no arguments or keywords.

Defaults

This command is disabled by default. All outgoing LSAs are flooded to the interface.

Command Modes

Interface configuration

Command History

Release	Modification
12.0	This command was introduced.

Usage Guidelines

This command performs the same function that the **neighbor database-filter** command performs on a neighbor basis.

Examples

The following example prevents flooding of OSPF LSAs to broadcast, nonbroadcast, or point-to-point networks reachable through Ethernet interface 0:

```
interface ethernet 0
 ip ospf database-filter all out
```

Related Commands

Command	Description
neighbor database-filter	Filters outgoing LSAs to an OSPF neighbor.

ip ospf dead-interval

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

ip ospf dead-interval *seconds*

no ip ospf dead-interval

Syntax Description	<i>seconds</i>	Unsigned integer that specifies the interval in seconds; the value must be the same for all nodes on the network.
---------------------------	----------------	---

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

Command Modes	Interface configuration
----------------------	-------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	The interval is advertised in the router's hello packets. This value must be the same for all routers and access servers on a specific network.
-------------------------	---

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

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

Related Commands	Command	Description
	ip ospf hello-interval	Specifies the interval between hello packets that the Cisco IOS software sends on the interface.

ip ospf demand-circuit

To configure OSPF to treat the interface as an OSPF demand circuit, use the **ip ospf demand-circuit** command in interface configuration mode. To remove the demand circuit designation from the interface, use the **no** form of this command.

ip ospf demand-circuit

no ip ospf demand-circuit

Syntax Description This command has no arguments or keywords.

Defaults The circuit is not a demand circuit.

Command Modes Interface configuration

Command History	Release	Modification
	11.2	This command was introduced.

Usage Guidelines On point-to-point interfaces, only one end of the demand circuit must be configured with this command. Periodic hellos are suppressed and periodic refreshes of LSAs do not flood the demand circuit. It allows the underlying datalink layer to be closed when the topology is stable. In point-to-multipoint topology, only the multipoint end must be configured with this command.

Examples The following example sets the configures an ISDN on demand circuit:

```
router ospf1
 network 10.0.3.0 255.255.255.0 area 0
 interface BRIO
 ip ospf demand-circuit
```

ip ospf hello-interval

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

ip ospf hello-interval *seconds*

no ip ospf hello-interval

Syntax Description	<i>seconds</i>	Unsigned integer that specifies the interval in seconds. The value must be the same for all nodes on a specific network.
---------------------------	----------------	--

Defaults	10 seconds
-----------------	------------

Command Modes	Interface configuration
----------------------	-------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	This value is advertised in the hello packets. The smaller the hello interval, the faster topological changes will be detected, but more routing traffic will ensue. This value must be the same for all routers and access servers on a specific network.
-------------------------	--

Examples	The following example sets the interval between hello packets to 15 seconds:
-----------------	--

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

Related Commands	Command	Description
	ip ospf dead-interval	Sets the time period for which hello packets must not have been seen before neighbors declare the router down.

ip ospf message-digest-key

To enable OSPF MD5 authentication, use the **ip ospf message-digest-key** command in interface configuration mode. To remove an old MD5 key, use the **no** form of this command.

ip ospf message-digest-key *keyid* **md5** *key*

no ip ospf message-digest-key *keyid*

Syntax Description

<i>keyid</i>	An identifier in the range 1 to 255.
<i>key</i>	Alphanumeric password of up to 16 bytes.

Defaults

OSPF MD5 authentication is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.

Usage Guidelines

Usually, one key per interface is used to generate authentication information when sending packets and to authenticate incoming packets. The same key identifier on the neighbor router must have the same *key* value.

The process of changing keys is as follows. Suppose the current configuration is as follows:

```
interface ethernet 1
 ip ospf message-digest-key 100 md5 OLD
```

You change the configuration to the following:

```
interface ethernet 1
 ip ospf message-digest-key 101 md5 NEW
```

The system assumes its neighbors do not have the new key yet, so it begins a rollover process. It sends multiple copies of the same packet, each authenticated by different keys. In this example, the system sends out two copies of the same packet—the first one authenticated by key 100 and the second one authenticated by key 101.

Rollover allows neighboring routers to continue communication while the network administrator is updating them with the new key. Rollover stops once the local system finds that all its neighbors know the new key. The system detects that a neighbor has the new key when it receives packets from the neighbor authenticated by the new key.

After all neighbors have been updated with the new key, the old key should be removed. In this example, you would enter the following:

```
interface ethernet 1
 no ip ospf message-digest-key 100
```

Then, only key 101 is used for authentication on Ethernet interface 1.

We recommend that you not keep more than one key per interface. Every time you add a new key, you should remove the old key to prevent the local system from continuing to communicate with a hostile system that knows the old key. Removing the old key also reduces overhead during rollover.

Examples

The following example sets a new key 19 with the password *8ry4222*:

```
interface ethernet 1
 ip ospf message-digest-key 10 md5 xv560qle
 ip ospf message-digest-key 19 md5 8ry4222
```

Related Commands

Command	Description
area authentication	Enables authentication for an OSPF area.

ip ospf name-lookup

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

ip ospf name-lookup

no ip ospf name-lookup

Syntax Description This command has no arguments or keywords.

Defaults This command is disabled by default.

Command Modes Global configuration

Command History	Release	Modification
	10.0	This command was introduced.

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

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

```
ip ospf name-lookup
```

ip ospf network

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

```
ip ospf network {broadcast | non-broadcast | {point-to-multipoint [non-broadcast]}}
```

```
no ip ospf network
```

Syntax Description

broadcast	Sets the network type to broadcast.
non-broadcast	Sets the network type to NBMA.
point-to-multipoint [non-broadcast]	Sets the network type to point-to-multipoint. The optional non-broadcast keyword sets the point-to-multipoint network to be nonbroadcast. If you use the non-broadcast keyword, the neighbor command is required.

Defaults

Depends on the network type.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The point-to-multipoint keyword was added.
11.3 AA	The non-broadcast keyword used with the point-to-multipoint keyword was added.

Usage Guidelines

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

Configuring NBMA networks as either broadcast or nonbroadcast assumes that there are virtual circuits from every router to every router or fully meshed network. This is not true for some cases, for example, because of cost constraints or when you have only a partially meshed network. In these cases, you can configure the OSPF network type as a point-to-multipoint network. Routing between two routers that are not directly connected will go through the router that has virtual circuits to both routers. You do not need to configure neighbors when using this feature.

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

OSPF has two features related to point-to-multipoint networks. One feature applies to broadcast networks; the other feature applies to nonbroadcast networks.

- On point-to-multipoint, broadcast networks, you can use the **neighbor** command and you must specify a cost to that neighbor.
- On point to multipoint, nonbroadcast networks, you must use the **neighbor** command to identify neighbors. Assigning a cost to a neighbor is optional.

Examples

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

```
interface serial 0
ip address 192.168.77.17 255.255.255.0
ip ospf network broadcast
encapsulation frame-relay
```

The following example illustrates a point-to-multipoint network with broadcast.

```
interface Serial0
ip address 10.0.1.1 255.255.255.0
encapsulation frame-relay
ip ospf cost 100
ip ospf network point-to-multipoint
frame-relay map ip 10.0.1.3 202 broadcast
frame-relay map ip 10.0.1.4 203 broadcast
frame-relay map ip 10.0.1.5 204 broadcast
frame-relay local-dlci 200
!
router ospf 1
network 10.0.1.0 0.0.0.255 area 0
neighbor 10.0.1.5 cost 5
neighbor 10.0.1.4 cost 10
```

Related Commands

Command	Description
frame-relay map	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.
neighbor (OSPF)	Configures OSPF routers interconnecting to nonbroadcast networks.
x25 map	Sets up the LAN protocols-to-remote host mapping.

ip ospf priority

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

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.
---------------------------	---------------	---

Defaults	Priority of 1
-----------------	---------------

Command Modes	Interface configuration
----------------------	-------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines

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

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

Examples

The following example sets the router priority value to 4:

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

Related Commands	Command	Description
	ip ospf network	Configures the OSPF network type to a type other than the default for a given medium.
	neighbor (OSPF)	Configures OSPF routers interconnecting to nonbroadcast networks.

ip ospf retransmit-interval

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

ip ospf retransmit-interval *seconds*

no ip ospf retransmit-interval

Syntax Description	<i>seconds</i>	Time in seconds between retransmissions. It must be greater than the expected round-trip delay between any two routers on the attached network. The range is 1 to 65535 seconds. The default is 5 seconds.
---------------------------	----------------	--

Defaults	5 seconds
-----------------	-----------

Command Modes	Interface configuration
----------------------	-------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	<p>When a router sends a link state advertisement (LSA) to its neighbor, it keeps the LSA until it receives back the acknowledgment. If it receives no acknowledgment in <i>seconds</i>, it will retransmit the LSA.</p> <p>The setting of this parameter should be conservative, or needless retransmission will result. The value should be larger for serial lines and virtual links.</p>
-------------------------	--

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

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

ip ospf transmit-delay

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

ip ospf transmit-delay *seconds*

no ip ospf transmit-delay

Syntax Description	<i>seconds</i>	Time in seconds that it takes to transmit a link state update. The range is 1 to 65535 seconds. The default is 1 second.
---------------------------	----------------	--

Defaults	1 second
-----------------	----------

Command Modes	Interface configuration
----------------------	-------------------------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	Link state advertisements in the update packet must have their ages incremented by the amount specified in the <i>seconds</i> 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.

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

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

neighbor (OSPF)

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

neighbor *ip-address* [**priority number**] [**poll-interval seconds**] [**cost number**]

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

Syntax Description

<i>ip-address</i>	Interface IP address of the neighbor.
priority number	(Optional) 8-bit number indicating the router priority value of the nonbroadcast neighbor associated with the IP address specified. The default is 0. This keyword does not apply to point-to-multipoint interfaces.
poll-interval seconds	(Optional) Unsigned integer value reflecting the poll interval. RFC 1247 recommends that this value be much larger than the hello interval. The default is 120 seconds (2 minutes). This keyword does not apply to point-to-multipoint interfaces.
cost number	(Optional) Assigns a cost to the neighbor, in the form of an integer from 1 to 65535. Neighbors with no specific cost configured will assume the cost of the interface, based on the ip ospf cost command. On point-to-multipoint interfaces, this is the only keyword and argument that make sense. This keyword does not apply to NBMA networks.

Defaults

No configuration is specified.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3 AA	The cost keyword was added.

Usage Guidelines

X.25 and Frame Relay provide an optional broadcast capability that can be configured in the map to allow OSPF to run as a broadcast network. At the OSPF level you can configure the router as a broadcast network. See the **x25 map** and **frame-relay map** commands in the “X.25 Commands” and “Frame Relay Commands” chapters, respectively, in the *Wide-Area Networking Command Reference* for more detail.

One neighbor entry must be included in the Cisco IOS software configuration for each known nonbroadcast network neighbor. The neighbor address has to be on the primary address of the interface.

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

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



Note

You cannot use the **neighbor (OSPF)** command to specify an Open Shortest Path First (OSPF) neighbor on non-broadcast networks within an OSPF Virtual Private Network (VPN) routing instance.

Prior to Release 12.0, the **neighbor** command applied to NBMA networks only. With Release 12.0, the **neighbor** command applies to NBMA networks and point-to-multipoint networks. On NBMA networks, the **cost** keyword is not accepted.

Examples

The following example declares a router at address 192.168.3.4 on a nonbroadcast network, with a priority of 1 and a poll interval of 180 seconds:

```
router ospf
  neighbor 192.168.3.4 priority 1 poll-interval 180
```

The following example illustrates a point-to-multipoint network with nonbroadcast:

```
interface Serial0
ip address 10.0.1.1 255.255.255.0
ip ospf network point-to-multipoint non-broadcast
encapsulation frame-relay
no keepalive
frame-relay local-dlci 200
frame-relay map ip 10.0.1.3 202
frame-relay map ip 10.0.1.4 203
frame-relay map ip 10.0.1.5 204
no shut
!
router ospf 1
network 10.0.1.0 0.0.0.255 area 0
neighbor 10.0.1.3 cost 5
neighbor 10.0.1.4 cost 10
neighbor 10.0.1.5 cost 15
```

Related Commands

Command	Description
ip ospf priority	“Sets the router priority, which helps determine the designated router for this network.”

neighbor database-filter

To filter outgoing LSAs to an OSPF neighbor, use the **neighbor database-filter** command in router configuration mode. To restore the forwarding of LSAs to the neighbor, use the **no** form of this command.

neighbor *ip-address* **database-filter all out**

no neighbor *ip-address* **database-filter all out**

Syntax Description	<i>ip-address</i> all out	IP address of the neighbor to which outgoing LSAs are blocked.
---------------------------	----------------------------------	--

Defaults	This command is disabled by default. All outgoing LSAs are flooded to the neighbor.	
-----------------	---	--

Command Modes	Router configuration	
----------------------	----------------------	--

Command History	Release	Modification
	12.0	This command was introduced.

Usage Guidelines	This command performs the same function that the ip ospf database-filter command performs on an interface basis.	
-------------------------	---	--

Examples	The following example prevents flooding of OSPF LSAs to point-to-multipoint networks to the neighbor at IP address 10.2.3.4:	
-----------------	--	--

```
router ospf 109
 neighbor 10.2.3.4 database-filter all out
```

Related Commands	Command	Description
	ip ospf database-filter	Filters outgoing LSAs to an OSPF interface.

network area

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

network *address wildcard-mask* **area** *area-id*

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

Syntax Description

<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 value of the <i>area-id</i> argument.

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

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*.

For OSPF to operate on the interface, that interface’s primary address must be covered by the **network area** command. If the **network area** command covers only the secondary address, it will not enable OSPF over that interface.

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

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

There is no limit to the number of **network area** commands you can use on the router.

**Note**

Any individual interface can only be attached to a single area. If the address ranges specified for different areas overlap, the software 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.

Examples

The following partial example initializes OSPF routing process 109, and defines four OSPF areas: 10.9.50.0, 2, 3, and 0. Areas 10.9.50.0, 2, and 3 mask specific address ranges, and area 0 enables OSPF for all other networks.

```
interface ethernet 0
  ip address 10.108.20.1 255.255.255.0
router ospf 109
  network 10.108.20.0 0.0.0.255 area 10.9.50.0
  network 10.108.0.0 0.0.255.255 area 2
  network 10.109.10.0 0.0.0.255 area 3
  network 0.0.0.0 255.255.255.255 area 0
```

Related Commands

Command	Description
router ospf	Configures an OSPF routing process.

ospf auto-cost

To control how OSPF calculates default metrics for the interface, use the **ospf auto-cost** command in router configuration mode. To assign cost based only on the interface type, use the **no** form of this command.

ospf auto-cost reference-bandwidth *ref-bw*

no ospf auto-cost reference-bandwidth

Syntax Description

reference-bandwidth *ref-bw* Rate in megabits per second (bandwidth). The range is 1 to 4294967; the default is 100.

Defaults

100 Mbits

Command Modes

Router configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

In Cisco IOS Release 10.3 and later, by default OSPF will calculate the OSPF metric for an interface according to the bandwidth of the interface. For example, a 64K link will get a metric of 1562, while a T1 link will have a metric of 64.

The OSPF metric is calculated as *ref-bw* divided by *bandwidth*, with *ref-bw* equal to 10^8 by default, and *bandwidth* determined by the **bandwidth** command. The calculation gives FDDI a metric of 1.

If you have multiple links with high bandwidth (such as FDDI or ATM), you might want to use a larger number to differentiate the cost on those links.

The value set by the **ip ospf cost** command overrides the cost resulting from the **ospf auto-cost** command.

Examples

The following example changes the cost of the FDDI link to 10, while the gigabit Ethernet link remains at a cost of 1. Thus, the link costs are differentiated.

```
router ospf 1
 ospf auto-cost reference-bandwidth 1000
```

Related Commands

Command	Description
ip ospf cost	Explicitly specifies the cost of sending a packet on an interface.

ospf ignore lsa mospf

To suppress the sending of syslog messages when the router receives LSA Type 6 (MOSPF) packets, which are unsupported, use the **ospf ignore lsa mospf** command in router configuration mode. To restore the sending of syslog messages, use the **no** form of this command.

ospf ignore lsa mospf

no ospf ignore lsa mospf

Syntax Description

This command has no arguments or keywords.

Defaults

This command is disabled by default. Each MOSPF packet causes the router to send a syslog message.

Command Modes

Router configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Cisco routers do not support LSA Type 6 (MOSPF), and they generate syslog messages if they receive such packets. If the router is receiving many MOSPF packets, you might want to configure the router to ignore the packets and thus prevent a large number of syslog messages.

Examples

The following example configures the router to suppress the sending of syslog messages when it receives MOSPF packets:

```
router ospf 109
 ospf ignore lsa mospf
```

ospf log-adjacency-changes

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

ospf log-adjacency-changes

no ospf log-adjacency-changes

Syntax Description This command has no arguments or keywords.

Defaults No such syslog message is sent.

Command Modes Router configuration

Command History	Release	Modification
	11.2	This command was introduced.

Usage Guidelines Configure this command if you want to know about OSPF neighbor changes without turning on the debugging command **debug ip ospf adjacency**. The **ospf log-adjacency-changes** command provides a higher level view of changes to the state of the peer relationship with less output.

Examples The following example configures the router to send a syslog message when OSPF neighbors go up or down:

```
ospf log-adjacency-changes
```

router-id

To use a fixed router-id, use the **router-id** command. To force OSPF to use the previous OSPF router-id behavior, use the **no** form of this command.

router-id *ip-address*

no router-id

Syntax Description	<i>ip-address</i>	Router ID in IP address format.
---------------------------	-------------------	---------------------------------

Defaults No OSPF routing process is defined.

Command Modes Router configuration

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines You can configure an arbitrary value in the IP address format for each router. However, each router ID must be unique.

If this command is used on an OSPF router process which is already active (has neighbors), the new router-ID is used at the next reload or at a manual OSPF process restart. To manually restart the OSPF process, use the **clear ip ospf** command.

Examples The following example specifies a fixed router-id:

```
router-id 10.1.1.1
```

Related Commands	Command	Description
	router ospf	Configures the OSPF routing process.

router ospf

To configure an Open Shortest Path First (OSPF) routing process, use the **router ospf** command in global configuration mode. To terminate an OSPF routing process, use the **no** form of this command.

```
router ospf process-id [vrf vpn-name]
```

```
no router ospf process-id [vrf vpn-name]
```

Syntax Description

<i>process-id</i>	Internally used identification parameter for an OSPF routing process. It is locally assigned and can be any positive integer. A unique value is assigned for each OSPF routing process.
vrf <i>vpn-name</i>	(Optional) Specifies the name of the VPN routing and forwarding (VRF) instance to associate with OSPF VRF processes.

Defaults

No OSPF routing process is defined.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(7)T	The vrf keyword and <i>vpn-name</i> arguments were added to identify a VPN.
12.0(9)ST	The vrf keyword and <i>vpn-name</i> arguments were added.

Usage Guidelines

You can specify multiple OSPF routing processes in each router.

Examples

The following example configures an OSPF routing process and assign a process number of 109:

```
router ospf 109
```

This example shows a basic OSPF configuration using the **router ospf** command to configure OSPF VPN routing and forwarding (VRF) instance processes for the VRFs first, second, and third:

```
Router> enable
Router# configure terminal
Router(config)# router ospf 12 vrf first
Router(config)# router ospf 13 vrf second
Router(config)# router ospf 14 vrf third
Router(config)# exit
```

Related Commands

Command	Description
network area	Defines the interfaces on which OSPF runs and defines the area ID for those interfaces.

show ip ospf

To display general information about OSPF routing processes, use the **show ip ospf** command in EXEC mode.

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

Syntax Description	<i>process-id</i>	(Optional) Process ID. If this argument is included, only information for the specified routing process is included.
---------------------------	-------------------	--

Command Modes	EXEC
----------------------	------

Command History	Release	Modification
	10.0	This command was introduced.

Examples The following is sample output from the **show ip ospf** command when entered without a specific OSPF process ID:

```
Router# show ip ospf

Routing Process "ospf 201" with ID 192.42.110.200
Supports only single TOS(TOS0) route
It is an area border and autonomous system boundary router
Redistributing External Routes from,
  igrp 200 with metric mapped to 2, includes subnets in redistribution
  rip with metric mapped to 2
  igrp 2 with metric mapped to 100
  igrp 32 with metric mapped to 1
Number of areas in this router is 3
Area 192.42.110.0
  Number of interfaces in this area is 1
  Area has simple password authentication
  SPF algorithm executed 6 times
```

Table 189 describes significant fields shown in the display.

Table 189 *show ip ospf Field Descriptions*

Field	Description
Routing process “ospf 201” with ID 192.42.110.200	Process ID and OSPF router ID.
Supports ...	Number of Types of service supported (Type 0 only).
It is ...	Possible types are internal, area border, or autonomous system boundary.
Summary Link update interval	Specify summary update interval in hours:minutes:seconds, and time to next update.
External Link update interval	Specify external update interval in hours:minutes:seconds, and time to next update.
Redistributing External Routes from	Lists of redistributed routes, by protocol.
Number of areas	Number of areas in router, area addresses, and so on.
Link State Update Interval	Specify router and network link state update interval in hours:minutes:seconds, and time to next update.
Link State Age Interval	Specify max-aged update deletion interval and time until next database cleanup in hours:minutes:seconds.

show ip ospf border-routers

To display the internal OSPF routing table entries to an area border router (ABR) and autonomous system boundary router (ASBR), use the **show ip ospf border-routers** command in privileged EXEC mode.

show ip ospf border-routers

Syntax Description This command has no arguments or keywords.

Command Modes Privileged EXEC

Command History	Release	Modification
	10.0	This command was introduced.

Examples The following is sample output from the **show ip ospf border-routers** command:

```
Router# show ip ospf border-routers

OSPF Process 109 internal Routing Table

Destination      Next Hop      Cost   Type   Rte Type Area      SPF No
-----
192.168.97.53    172.16.1.53  10     ABR    INTRA   0.0.0.3    3
192.168.103.51  192.168.96.51 10     ABR    INTRA   0.0.0.3    3
192.168.103.52  192.168.96.51 20     ASBR   INTER   0.0.0.3    3
192.168.103.52  172.16.1.53  22     ASBR   INTER   0.0.0.3    3
```

Table 190 describes the fields shown in the display.

Table 190 Show IP OSPF Border-Routers Field Descriptions

Field	Description
Destination	Destination's router ID.
Next Hop	Next hop toward the destination.
Cost	Cost of using this route.
Type	The router type of the destination; it is either an area border router (ABR) or autonomous system boundary router (ASBR) or both.
Rte Type	The type of this route, it is either an intra-area or interarea route.
Area	The area ID of the area that this route is learned from.
SPF No	The internal number of SPF calculation that installs this route.

show ip ospf database

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

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

```
show ip ospf [process-id area-id] database [adv-router [ip-address]]
```

```
show ip ospf [process-id area-id] database [asbr-summary] [link-state-id]
```

```
show ip ospf [process-id area-id] database [asbr-summary] [link-state-id] [adv-router  
[ip-address]]
```

```
show ip ospf [process-id area-id] database [asbr-summary] [link-state-id] [self-originate]  
[link-state-id]
```

```
show ip ospf [process-id area-id] database [database-summary]
```

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

```
show ip ospf [process-id] database [external] [link-state-id] [adv-router [ip-address]]
```

```
show ip ospf [process-id area-id] database [external] [link-state-id] [self-originate]  
[link-state-id]
```

```
show ip ospf [process-id area-id] database [network] [link-state-id]
```

```
show ip ospf [process-id area-id] database [network] [link-state-id] [adv-router [ip-address]]
```

```
show ip ospf [process-id area-id] database [network] [link-state-id] [self-originate]  
[link-state-id]
```

```
show ip ospf [process-id area-id] database [nssa-external] [link-state-id]
```

```
show ip ospf [process-id area-id] database [nssa-external] [link-state-id] [adv-router  
[ip-address]]
```

```
show ip ospf [process-id area-id] database [nssa-external] [link-state-id] [self-originate]  
[link-state-id]
```

```
show ip ospf [process-id area-id] database [router] [link-state-id]
```

```
show ip ospf [process-id area-id] database [router] [adv-router [ip-address]]
```

```
show ip ospf [process-id area-id] database [router] [self-originate] [link-state-id]
```

```
show ip ospf [process-id area-id] database [self-originate] [link-state-id]
```

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

```
show ip ospf [process-id area-id] database [summary] [link-state-id] [adv-router [ip-address]]
```

```
show ip ospf [process-id area-id] database [summary] [link-state-id] [self-originate]  
[link-state-id]
```

Syntax Description	
<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. 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>	<p>(Optional) 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.</p> <p>When the link state advertisement is describing a network, the <i>link-state-id</i> can take one of two forms:</p> <p>The network's IP address (as in type 3 summary link advertisements and in autonomous system external link advertisements).</p> <p>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.)</p> <p>When the link state advertisement is describing a router, the link state ID is always the described router's OSPF router ID.</p> <p>When an autonomous system external advertisement (LS Type = 5) is describing a default route, its link state ID is set to Default Destination (0.0.0.0).</p>
adv-router [<i>ip-address</i>]	(Optional) Displays all the LSAs of the specified router. If no IP address is included, the information is about the local router itself (in this case, the same as self-originate).
asbr-summary	(Optional) Displays information only about the autonomous system boundary router summary LSAs.
database-summary	(Optional) Displays how many of each type of LSA for each area there are in the database, and the total.
external	(Optional) Displays information only about the external LSAs.
network	(Optional) Displays information only about the network LSAs.
nssa-external	(Optional) Displays information only about the NSSA external LSAs.
router	(Optional) Displays information only about the router LSAs.
self-originate	(Optional) Displays only self-originated LSAs (from the local router).
summary	(Optional) Displays information only about the summary LSAs.

Command Modes EXEC

Command History	Release	Modification
	10.0	This command was introduced.

Release	Modification
11.0	The database-summary keyword was added.
12.0	The following keywords were added: <ul style="list-style-type: none"> • self-originate • adv-router

Examples

The following is sample output from the **show ip ospf database** command when no arguments or keywords are used:

```
Router# show ip ospf database
```

```
OSPF Router with id(192.168.239.66) (Process ID 300)
```

```
Displaying Router Link States(Area 0.0.0.0)
```

Link ID	ADV Router	Age	Seq#	Checksum	Link count
172.16.21.6	172.16.21.6	1731	0x80002CFB	0x69BC	8
172.16.21.5	172.16.21.5	1112	0x800009D2	0xA2B8	5
172.16.1.2	172.16.1.2	1662	0x80000A98	0x4CB6	9
172.16.1.1	172.16.1.1	1115	0x800009B6	0x5F2C	1
172.16.1.5	172.16.1.5	1691	0x80002BC	0x2A1A	5
172.16.65.6	172.16.65.6	1395	0x80001947	0xEE1	4
172.16.241.5	172.16.241.5	1161	0x8000007C	0x7C70	1
172.16.27.6	172.16.27.6	1723	0x80000548	0x8641	4
172.16.70.6	172.16.70.6	1485	0x80000B97	0xEB84	6

```
Displaying Net Link States(Area 0.0.0.0)
```

Link ID	ADV Router	Age	Seq#	Checksum
172.16.1.3	192.168.239.66	1245	0x800000EC	0x82E

```
Displaying Summary Net Link States(Area 0.0.0.0)
```

Link ID	ADV Router	Age	Seq#	Checksum
172.16.240.0	172.16.241.5	1152	0x80000077	0x7A05
172.16.241.0	172.16.241.5	1152	0x80000070	0xAEB7
172.16.244.0	172.16.241.5	1152	0x80000071	0x95CB

Table 191 describes significant fields shown in the display.

Table 191 show ip ospf Database Field Descriptions

Field	Description
Link ID	Router ID number.
ADV Router	Advertising router's ID.
Age	Link state age.
Seq#	Link state sequence number (detects old or duplicate link state advertisements).
Checksum	Fletcher checksum of the complete contents of the link state advertisement.
Link count	Number of interfaces detected for router.

The following is sample output from the **show ip ospf database** command with the **asbr-summary** keyword:

```
Router# show ip ospf database asbr-summary

OSPF Router with id(192.168.239.66) (Process ID 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: 172.16.245.1 (AS Boundary Router address)
Advertising Router: 172.16.241.5
LS Seq Number: 80000072
Checksum: 0x3548
Length: 28
Network Mask: 0.0.0.0 TOS: 0 Metric: 1
```

Table 192 describes significant fields shown in the display.

Table 192 *show ip ospf database asbr-summary* Field Descriptions

Field	Description
OSPF Router with id	Router ID number.
Process ID	OSPF process ID.
LS age	Link state age.
Options	Type of service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID (autonomous system boundary router).
Advertising Router	Advertising router's 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.

The following is sample output from the **show ip ospf database** command with the **external** keyword:

```
Router# show ip ospf database external

OSPF Router with id(192.168.239.66) (Autonomous system 300)

        Displaying AS External Link States

LS age: 280
Options: (No TOS-capability)
LS Type: AS External Link
Link State ID: 10.105.0.0 (External Network Number)
Advertising Router: 172.16.70.6
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 193 describes significant fields shown in the display.

Table 193 *show ip ospf database external Field Descriptions*

Field	Description
OSPF Router with id	Router ID number.
Autonomous system	OSPF autonomous system number (OSPF process ID).
LS age	Link state age.
Options	Type of service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID (external network number).
Advertising Router	Advertising router's 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 LSA).
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.

The following is sample output from the **show ip ospf database** command with the **network** keyword:

```
Router# show ip ospf database network
  OSPF Router with id(192.168.239.66) (Process ID 300)

      Displaying Net Link States(Area 0.0.0.0)

LS age: 1367
Options: (No TOS-capability)
LS Type: Network Links
Link State ID: 172.16.1.3 (address of Designated Router)
Advertising Router: 192.168.239.66
LS Seq Number: 800000E7
Checksum: 0x1229
Length: 52
Network Mask: 255.255.255.0
    Attached Router: 192.168.239.66
    Attached Router: 172.16.241.5
    Attached Router: 172.16.1.1
    Attached Router: 172.16.54.5
    Attached Router: 172.16.1.5
```

Table 194 describes significant fields shown in the display.

Table 194 show ip ospf database network Field Descriptions

Field	Description
OSPF Router with id	Router ID number.
Process ID 300	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 of designated router.
Advertising Router	Advertising router's ID.
LS Seq Number	Link state sequence (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
Network Mask	Network mask implemented.
AS Boundary Router	Definition of router type.
Attached Router	List of routers attached to the network, by IP address.

The following is sample output from the **show ip ospf database** command with the **router** keyword:

```
Router# show ip ospf database router

OSPF Router with id(192.168.239.66) (Process ID 300)

        Displaying Router Link States(Area 0.0.0.0)

LS age: 1176
Options: (No TOS-capability)
LS Type: Router Links
Link State ID: 172.16.21.6
Advertising Router: 172.16.21.6
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: 172.16.21.5
(Link Data) Router Interface address: 172.16.21.6
Number of TOS metrics: 0
TOS 0 Metrics: 2
```

Table 195 describes significant fields shown in the display.

Table 195 *show ip ospf database router Field Descriptions*

Field	Description
OSPF Router with id	Router ID number.
Process ID	OSPF process ID.
LS age	Link state age.
Options	Type of service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID.
Advertising Router	Advertising router's ID.
LS Seq Number	Link state sequence (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
AS Boundary Router	Definition of router type.
Number of Links	Number of active links.
link ID	Link type.
Link Data	Router interface address.
TOS	Type of service metric (Type 0 only).

The following is sample output from **show ip ospf database** command with the **summary** keyword:

```
Router# show ip ospf database summary

      OSPF Router with id(192.168.239.66) (Process ID 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: 172.16.240.0 (summary Network Number)
Advertising Router: 172.16.241.5
LS Seq Number: 80000072
Checksum: 0x84FF
Length: 28
Network Mask: 255.255.255.0   TOS: 0   Metric: 1
```

Table 196 describes significant fields shown in the display.

Table 196 *show ip ospf database summary Field Descriptions*

Field	Description
OSPF Router with id	Router ID number.
Process ID	OSPF process ID.
LS age	Link state age.
Options	Type of service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID (summary network number).
Advertising Router	Advertising router's 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.

The following is sample output from **show ip ospf database** command with the **database-summary** keyword:

```
Router# show ip ospf database database-summary

      OSPF Router with ID (172.19.65.21) (Process ID 1)

Area ID      Router  Network  Sum-Net  Sum-ASBR  Subtotal  Delete  Maxage
202          1       0        0        0         1        0       0
AS External
Total       1       0        0        0         1        0       0
```

Table 197 describes significant fields shown in the display.

Table 197 *show ip ospf database database-summary Field Descriptions*

Field	Description
Area ID	Area number.
Router	Number of router link state advertisements in that area.
Network	Number of network link state advertisements in that area.
Sum-Net	Number of summary link state advertisements in that area.
Sum-ASBR	Number of summary autonomous system boundary router (ASBR) link state advertisements in that area.
Subtotal	Sum of Router, Network, Sum-Net, and Sum-ASBR for that area.
Delete	Number of link state advertisements that are marked “Deleted” in that area.
Maxage	Number of link state advertisements that are marked “Maxaged” in that area.
AS External	Number of external link state advertisements.

show ip ospf interface

To display OSPF-related interface information, use the **show ip ospf interface** command in EXEC mode.

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

Syntax Description	
<i>type</i>	(Optional) Interface type.
<i>number</i>	(Optional) Interface number.

Command Modes EXEC

Command History	Release	Modification
	10.0	This command was introduced.

Examples

The following is sample output of the **show ip ospf interface** command when Ethernet 0 is specified:

```
Router# show ip ospf interface ethernet 0
```

```
Ethernet 0 is up, line protocol is up
Internet Address 192.168.254.202, 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 192.168.254.10, Interface address 192.168.254.10
Backup Designated router id 192.168.254.28, Interface addr 192.168.254.28
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 192.168.254.28 (Backup Designated Router)
  Adjacent with neighbor 192.168.254.10 (Designated Router)
```

Table 198 describes significant fields shown in the display.

Table 198 *show ip ospf interface Field Descriptions*

Field	Description
Ethernet	Status of physical link and operational status of protocol.
Internet Address	Interface IP address, subnet mask, and area address.
AS	Autonomous system number (OSPF process ID), router ID, network type, link state cost.
Transmit Delay	Transmit delay, interface state, and router priority.
Designated Router	Designated router ID and respective interface IP address.
Backup Designated router	Backup designated router ID and respective interface IP address.
Timer intervals configured	Configuration of timer intervals.

Table 198 *show ip ospf interface Field Descriptions (continued)*

Field	Description
Hello	Number of seconds until next hello packet is sent out this interface.
Neighbor Count	Count of network neighbors and list of adjacent neighbors.

show ip ospf neighbor

To display OSPF-neighbor information on a per-interface basis, use the **show ip ospf neighbor** command in EXEC mode.

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

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

Command Modes EXEC

Command History	Release	Modification
	10.0	This command was introduced.

Examples

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

```
Router# show ip ospf neighbor
```

ID	Pri	State	Dead Time	Address	Interface
10.199.199.137	1	FULL/DR	0:00:31	192.168.80.37	Ethernet0
172.16.48.1	1	FULL/DROTHER	0:00:33	172.16.48.1	Fddi0
172.16.48.200	1	FULL/DROTHER	0:00:33	172.16.48.200	Fddi0
10.199.199.137	5	FULL/DR	0:00:33	172.16.48.189	Fddi0

The following is sample output showing summary information about the neighbor that matches the neighbor ID:

```
Router# show ip ospf neighbor 10.199.199.137
```

```
Neighbor 10.199.199.137, interface address 192.168.80.37
  In the area 0.0.0.0 via interface Ethernet0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 0:00:32
  Link State retransmission due in 0:00:04
Neighbor 10.199.199.137, interface address 172.16.48.189
  In the area 0.0.0.0 via interface Fddi0
  Neighbor priority is 5, State is FULL
  Options 2
  Dead timer due in 0:00:32
  Link State retransmission due in 0:00:03
```

If you specify the interface along with the Neighbor ID, the Cisco IOS software displays the neighbors that match the neighbor ID on the interface, as in the following sample display:

```
Router# show ip ospf neighbor ethernet 0 10.199.199.137
```

```
Neighbor 10.199.199.137, interface address 192.168.80.37
  In the area 0.0.0.0 via interface Ethernet0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 0:00:37
  Link State retransmission due in 0:00:04
```

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

```
Router# show ip ospf neighbor fddi 0
```

```
      ID          Pri  State          Dead Time    Address        Interface
172.16.48.1      1  FULL/DROTHER  0:00:33     172.16.48.1   Fddi0
172.16.48.200   1  FULL/DROTHER  0:00:32     172.16.48.200 Fddi0
10.199.199.137  5  FULL/DR       0:00:32     172.16.48.189 Fddi0
```

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

```
Router# show ip ospf neighbor detail
```

```
Neighbor 192.168.96.54, interface address 192.168.96.54
  In the area 0.0.0.3 via interface Ethernet0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 0:00:38
Neighbor 192.168.103.52, interface address 192.168.103.52
  In the area 0.0.0.0 via interface Serial0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 0:00:31
```

Table 199 describes the fields shown in the displays.

Table 199 show ip ospf neighbor Field Descriptions

Field	Description
Neighbor	Neighbor router ID.
interface address	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 Cisco IOS software will declare neighbor dead.

show ip ospf request-list

To display a list of all link state advertisements (LSAs) requested by a router, use the **show ip ospf request-list** command in EXEC mode.

```
show ip ospf request-list [nbr] [intf] [intf-nbr]
```

Syntax Description		
<i>nbr</i>	(Optional) Neighbor. Displays the list of all LSAs requested by the router from this neighbor.	
<i>intf</i>	(Optional) Interface. Displays the list of all LSAs requested by the router from this interface.	
<i>intf-nbr</i>	(Optional) Displays the list of all LSAs requested by the router on this interface, from this neighbor.	

Command Modes	
	EXEC

Command History	Release	Modification
	10.2	This command was introduced.

Usage Guidelines

The information displayed by the **show ip ospf request-list** command is useful in debugging OSPF routing operations.

Examples

The following is sample output from the **show ip ospf request-list** command:

```
router# show ip ospf request-list se0

          OSPF Router with ID (200.1.1.11) (Process ID 1)

Neighbor 200.1.1.12, interface Serial0 address 172.16.1.12

Type  LS ID          ADV RTR          Seq NO          Age          Checksum
  1   200.1.1.12      200.1.1.12      0x8000020D      8           0x6572
```

show ip ospf retransmission-list

To display a list of all link state advertisements (LSAs) waiting to be retransmitted, use the **show ip ospf retransmission-list** command in EXEC mode.

```
show ip ospf retransmission-list [nbr] [intf] [intf-nbr]
```

Syntax Description		
<i>nbr</i>	(Optional) Neighbor. Displays the list of all LSAs waiting to be retransmitted for this neighbor.	
<i>intf</i>	(Optional) Interface. Displays the list of all LSAs waiting to be retransmitted on this interface.	
<i>intf-nbr</i>	(Optional) Displays the list of all LSAs waiting to be retransmitted on this interface, from this neighbor.	

Command Modes	
	EXEC

Command History	Release	Modification
	10.2	This command was introduced.

Usage Guidelines The information displayed by the **show ip ospf retransmission-list** command is useful in debugging OSPF routing operations.

Examples The following is sample output from the **show ip ospf retransmission-list** command:

```
Router# show ip ospf retransmission-list se0

      OSPF Router with ID (200.1.1.12) (Process ID 1)

Neighbor 200.1.1.11, interface Serial0 address 172.16.1.11
Link state retransmission due in 3764 msec, Queue length 2

Type  LS ID      ADV RTR      Seq NO      Age      Checksum
  1   200.1.1.12   200.1.1.12   0x80000210   0        0xB196
```

show ip ospf summary-address

To display a list of all summary address redistribution information configured under an OSPF process, use the **show ip ospf summary-address** command in EXEC mode.

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

Syntax Description	<i>process-id</i>	(Optional) OSPF area ID.
---------------------------	-------------------	--------------------------

Command Modes	EXEC
----------------------	------

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines	The <i>process-id</i> can be entered as a decimal number or as an IP address format.
-------------------------	--

Examples	The following is sample output from the show ip ospf summary-address command:
-----------------	--

```
Router# show ip ospf summary-address

OSPF Process 2, Summary-address

10.2.0.0/255.255.0.0 Metric -1, Type 0, Tag 0
10.2.0.0/255.255.0.0 Metric -1, Type 0, Tag 10
```

show ip ospf virtual-links

To display parameters about and the current state of OSPF virtual links, use the **show ip ospf virtual-links** command in EXEC mode.

show ip ospf virtual-links

Syntax Description This command has no arguments or keywords.

Command Modes EXEC

Command History	Release	Modification
	10.0	This command was introduced.

Usage Guidelines The information displayed by the **show ip ospf virtual-links** command is useful in debugging OSPF routing operations.

Examples The following is sample output from the **show ip ospf virtual-links** command:

```
Router# show ip ospf virtual-links

Virtual Link to router 192.168.101.2 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 200 describes significant fields shown in the display.

Table 200 *show ip ospf virtual-links Field Descriptions*

Field	Description
Virtual Link to router 192.168.101.2 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 (in seconds) on the virtual link.
State POINT_TO_POINT	The state of the OSPF neighbor.
Timer intervals...	The various timer intervals configured for the link.

Table 200 *show ip ospf virtual-links Field Descriptions (continued)*

Field	Description
Hello due in 0:00:08	When the next hello is expected from the neighbor.
Adjacency State FULL	The adjacency state between the neighbors.

summary-address (OSPF)

Use the **summary-address** command in router configuration mode to create aggregate addresses for OSPF. The **no summary-address** command restores the default.

```
summary-address address mask {level-1 | level-1-2 | level-2} prefix mask [not-advertise]
[tag tag]
```

```
no summary-address address mask {level-1 | level-1-2 | level-2}
```

Syntax Description

<i>address</i>	Summary address designated for a range of addresses.
<i>mask</i>	IP subnet mask used for the summary route.
level-1	Only routes redistributed into Level 1 are summarized with the configured address/mask value. This keyword applies to IS-IS only.
level-1-2	The summary router is injected into both a Level 1 area and a Level 2 subdomain. This keyword applies to IS-IS only.
level-2	Routes learned by Level 1 routing will be summarized into the Level 2 backbone with the configured address/mask value. This keyword applies to IS-IS only.
<i>prefix</i>	IP route prefix for the destination.
<i>mask</i>	IP subnet mask used for the summary route.
<i>not-advertise</i>	(Optional) Used to suppress routes that match the prefix/mask pair. This keyword applies to OSPF only.
tag tag	(Optional) Tag value that can be used as a “match” value for controlling redistribution via route maps. This keyword applies to OSPF only.

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Routes learned from other routing protocols can be summarized. The metric used to advertise the summary is the smallest metric of all the more specific routes. This command helps reduce the size of the routing table.

Using this command for OSPF causes an OSPF autonomous system boundary router (ASBR) to advertise one external route as an aggregate for all redistributed routes that are covered by the address. For OSPF, this command summarizes only routes from other routing protocols that are being redistributed into OSPF. Use the **area range** command for route summarization between OSPF areas.

Examples

In the following example, summary address 10.1.0.0 includes address 10.1.1.0, 10.1.2.0, 10.1.3.0, and so forth. Only the address 10.1.0.0 is advertised in an external link state advertisement.

```
summary-address 10.1.0.0 255.255.0.0
```

Related Commands

Command	Description
area range	Consolidates and summarizes routes at an area boundary.
ip ospf authentication	Assigns a password to be used by neighboring routers that are using the simple password authentication of OSPF.
ip ospf message-digest-key	Enables OSPF MD5 authentication.

timers lsa-group-pacing

To change the interval at which OSPF LSAs are collected into a group and refreshed, checksummed, or aged, use the **timers lsa-group-pacing** command in router configuration mode. To restore the default value, use the **no** form of this command.

timers lsa-group-pacing *seconds*

no timers lsa-group-pacing

Syntax Description

<i>seconds</i>	Number of seconds in the interval at which LSAs are grouped and refreshed, checksummed, or aged. The range is 10 seconds to 1800 seconds. The default value is 240 seconds.
----------------	---

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
11.3 AA	This command was introduced.

Usage Guidelines

OSPF LSA group pacing is enabled by default. For typical customers, the default group pacing interval for refreshing, checksumming, and aging is appropriate and you need not configure this feature.

The duration of the LSA group pacing is inversely proportional to the number of LSAs the router is handling. For example, if you have approximately 10,000 LSAs, decreasing the pacing interval would benefit you. If you have a very small database (40 to 100 LSAs), increasing the pacing interval to 10 to 20 minutes might benefit you slightly.

Examples

The following example changes the OSPF pacing between LSA groups to 60 seconds:

```
router ospf
 timers lsa-group-pacing 60
```

timers spf

To configure the delay time between when OSPF receives a topology change and when it starts a shortest path first (SPF) calculation, and the hold time between two consecutive SPF calculations, use the **timers spf** command in router configuration mode. To return to the default timer values, use the **no** form of this command.

```
timers spf spf-delay spf-holdtime
```

```
no timers spf spf-delay spf-holdtime
```

Syntax Description

<i>spf-delay</i>	Delay time, in seconds, between when OSPF receives a topology change and when it starts a SPF calculation. It can be an integer from 0 to 65535. The default time is 5 seconds. A value of 0 means that there is no delay; that is, the SPF calculation is started immediately.
<i>spf-holdtime</i>	Minimum time, in seconds, between two consecutive SPF calculations. It can be an integer from 0 to 65535. The default time is 10 seconds. A value of 0 means that there is no delay; that is, two consecutive SPF calculations can be done one immediately after the other.

Defaults

This command is disabled by default.

Command Modes

Router configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

Setting the delay and hold time low causes routing to switch to the alternate path more quickly in the event of a failure. However, it consumes more CPU processing time.

Examples

The following example changes the delay to 10 seconds and the hold time to 20 seconds:

```
timers spf 10 20
```