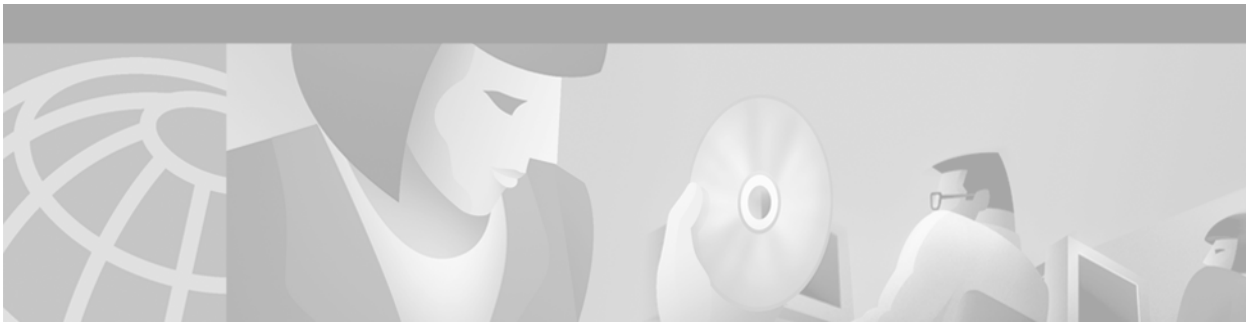

# OSPF Commands

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 *Cisco IOS IP Configuration Guide*.

# area authentication

To enable authentication for an OSPF area, use the **area authentication** command in router configuration mode. To remove an authentication specification of an area 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** [**message-digest**]

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier of the area for which authentication is to be enabled. The identifier can be specified as either a decimal value or an IP address. |
| **message-digest** | (Optional) Enables Message Digest 5 (MD5) authentication on the area specified by the *area-id* argument. |

## 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-key** interface 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** interface command.

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

**Note** To remove the specified area from the software configuration, use the **no area** *area-id* command (with no other keywords). That is, the **no area** *area-id* command 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 adcdefgh
!
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-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. |

# area default-cost

To specify a cost for the default summary route sent into a stub or not so stubby area (NSSA), 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

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

## Defaults

*cost*: 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 (ABR) attached to a stub or NSSA.

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 ABR attached to the stub area. The **default-cost** option provides the metric for the summary default route generated by the ABR into the stub area.

**Note** To remove the specified area from the software configuration, use the **no area** *area-id* command (with no other keywords). That is, the **no area** *area-id* command 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 stub** | Defines an area as a stub area. |

# area filter-list

To filter prefixes advertised in type 3 link-state advertisements (LSAs) between Open Shortest Path First (OSPF) areas of an area border router (ABR), use the **area filter-list** command. To change or cancel the filter, use the no form of this command.

**area** {*area-id*} **filter-list prefix** {*prefix-list-name* **in** | **out**}

**no area** {*area-id*} **filter-list prefix** {*prefix-list-name* **in** | **out**}

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier of the area for which filtering is configured. The identifier can be specified as either a decimal value or an IP address. |
| **prefix** | Indicates that a prefix list is used. |
| *prefix-list-name* | Name of a prefix list. |
| **in** | Prefix-list applied to prefixes advertised to the specified area from other areas. |
| **out** | Prefix-list applied to prefixes advertised out of the specified area to other areas. |

## Defaults

This command has no default behavior.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(15)S | This command was introduced. |

## Usage Guidelines

With this feature enabled in the "in" direction, all type 3 LSAs originated by the ABR to this area, based on information from all other areas, are filtered by the prefix list. Type 3 LSAs that were originated as a result of the **area-range** command in another area are treated like any other type 3 LSA that was originated individually. Any prefix that does not match an entry in the prefix list is implicitly denied.

With this feature enabled in the "out" direction, all type 3 LSAs advertised by the ABR, based on information from this area to all other areas, are filtered by the prefix list. If the **area-range** command has been configured for this area, type 3 LSAs that correspond to the area range are sent to all other areas, only if there is at least one prefix in the area range that matches an entry in the prefix list.

If all specific prefixes are denied by the prefix list, type 3 LSAs that correspond to the **area-range** command will not be sent to any other area. Prefixes that are not permitted by the prefix list are implicitly denied.

## Examples

The following example filters prefixes that are sent from all other areas to area 1:

```
area 1 filter-list prefix-list AREA_1 in
```

# 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-redistribution**] [**default-information-originate** [**metric**] [**metric-type**]] [**no-summary**]

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier of the area for which authentication is to be enabled. The identifier can be specified as either a decimal value or an IP address. |
| **no-redistribution** | (Optional) Used when the router is an NSSA Area Border Router (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 keyword takes effect only on NSSA ABR or NSSA Autonomous System Boundary Router (ASBR). |
| **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

To remove the specified area from the software configuration, use the **no area** *area-id* command (with no other keywords). That is, the **no area** *area-id* command 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 makes area 1 an NSSA area:

```
router ospf 1
 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** *ip-address mask* [**advertise** | **not-advertise**] [**cost** *cost*]

**no area** *area-id* **range** *ip-address mask* [**advertise** | **not-advertise**] [**cost** *cost*]

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier of the area about which routes are to be summarized. It can be specified as either a decimal value or as an IP address. |
| *ip-address* | IP address. |
| *mask* | IP address mask. |
| **advertise** | (Optional) Sets the address range status to advertise and generates a Type 3 summary link-state advertisement (LSA). |
| **not-advertise** | (Optional) Sets the address range status to DoNotAdvertise. The Type 3 summary LSA is suppressed, and the component networks remain hidden from other networks. |
| **cost** *cost* | (Optional) Metric or cost for this summary route, which is used during OSPF SPF calculation to determine the shortest paths to the destination. The value can be 0 to 16777215. |

## Defaults

This command is disabled by default.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 10.0 | This command was introduced. |
| 12.2 | The **cost** *cost* keyword and argument were added. |

## 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 **no area** *area-id* command (with no other keywords). That is, the **no area** *area-id* command 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 192.168.120.201 255.255.255.0
!
router ospf 201
 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 192.168.110.0 255.255.0.0 cost 60
```

## 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 nssa** | Configures an area as an NSSA. |
| **area stub** | Defines an area as a stub area. |
| **area virtual-link** | Defines an OSPF virtual link. |

# 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-summary**]

## Syntax Description

| | |
|---|---|
| *area-id* | Identifier for the stub area; either a decimal value or an IP address. |
| **no-summary** | (Optional) Prevents an Area Border Router (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 ABR.

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 ABR into the stub area.

To further reduce the number of link-state advertisements (LSAs) sent into a stub area, you can configure the **no-summary** keyword 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 **no area** *area-id* command (with no other keywords). That is, the **no area** *area-id* command 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** *key-id* **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** *key-id* **md5** *key*]]

**no area** *area-id*

## Syntax Description

| | |
|---|---|
| *area-id* | Area ID assigned to the transit area for the virtual link. This can be either a decimal value or a valid IP address. There is no default. |
| *router-id* | Router ID associated with the virtual link neighbor. The router ID appears in the **show ip ospf** display. The router ID is internally derived by each router from the 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** *seconds* | (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 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** *seconds* | (Optional) Time (in seconds) between link-state advertisement (LSA) 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** *seconds* | (Optional) Estimated time (in seconds) required to send a link-state update packet on the interface. Integer value that must be greater than zero. LSAs in the update packet have their age incremented by this amount before transmission. The default value is 1 second. |
| **dead-interval** *seconds* | (Optional) Time (in seconds) that hello packets are not seen before a neighbor declares 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** *key* | (Optional) Password to be used by neighboring routers. It is 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** *key-id* **md5** *key* | (Optional) Key identifier and password to be used by neighboring routers and this router for Message Digest 5 (MD5) authentication. The *key-id* argument is a number in the range from 1 to 255. The *key* 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 **message-digest-key** *key-id* **md5** *key* keywords and arguments were added. |
| 12.0 | The **authentication**, **message-digest**, and **null** keywords were added. |

## 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.

For Cisco IOS Release 12.2 and later releases, authentication type now is specified on a per-interface basis, rather than on a per-area basis, per RFC 2178. For backward compatability, authentication type for an area is still supported. If the authentication type is not specified for an interface, the interface will use the authentication type that was specified for the area. If no authentication type has been specified for the area, the area default is null authentication.

**Note** Each virtual link neighbor must include the transit area ID and the corresponding virtual link neighbor 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 **no area** *area-id* command (with no other keywords). That is, the **no area** *area-id* command 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** *ref-bw* | Rate in Mbps (bandwidth). The range is from 1 to 4294967; the default is 100. |

## Defaults

100 Mbps

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 11.2 | This command was introduced. |

## Usage Guidelines

In Cisco IOS Release 10.3 and later releases, 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 the *ref-bw* value divided by the 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 **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** [*neighbor-interface*] [*neighbor-id*]]}

## Syntax Description

| | |
|---|---|
| *pid* | (Optional) Process ID. |
| **process** | Reset OSPF process. |
| **redistribution** | Clear OSPF route redistribution. |
| **counters** | OSPF counters. |
| **neighbor** | (Optional) Neighbor statistics per interface. |
| *neighbor-interface* | (Optional) Neighbor interface. |
| *neighbor-id* | (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

## Command History

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

## Usage Guidelines

This command is backward compatible with Cisco IOS Release 12.0.

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 external 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*] [**route-map** *map-name*]

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

## Syntax Description

| | |
|---|---|
| **always** | (Optional) Always advertises the default route regardless of whether the software has a default route. |
| **metric** *metric-value* | (Optional) Metric used for generating the default route. If you omit a value and do not specify a value using the **default-metric** router configuration command, the default metric value is 1. The value used is specific to the protocol. |
| **metric-type** *type-value* | (Optional) External link type associated with the default route advertised into the OSPF routing domain. It can be one of the following values:<br>**1**—Type 1 external route<br>**2**—Type 2 external route<br>The default is type 2 external route. |
| **route-map** *map-name* | (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 and argument. 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.

**Notes:**

- If you use the **ip prefix-list** command with the **default-information originate** command to generate default routes, specify only IP adress matching. Avoid using the **ge** and **le** keywords.

  For example, the following command works:

  ```
  ip prefix-list anyrtcondition seq 5 permit 0.0.0.0/0
  ```

  However, the following command is not supported:

  ```
  ip prefix-list anyrtcondition seq 5 permit 0.0.0.0/0 le 32
  ```

- Using the **ip prefix-list** command with the **route-map** and **match ip next-hop** commands is not supported. Only IP address match clauses are supported.

## 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 igrp 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 the **default-metric** command in router configuration mode. To return to the default state, use the **no** form of this command.

**default-metric** *metric-value*

**no default-metric** *metric-value*

## Syntax Description

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

## Defaults

Built-in, automatic metric translations, as appropriate for each routing protocol. The metric of redistributed connected and static routes is set to 0.

## Command Modes

Router configuration

## 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.

**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 Routing Information Protocol (RIP) and the OSPF routing protocols. The example advertises OSPF-derived routes using RIP and assigns the Internal Gateway Routing Protocol (IGRP)-derived routes a RIP metric of 10.

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

## Related Commands

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

# discard-route

To reinstall either an external or internal discard route that was previously removed, use the **discard-route** command in router configuration mode. To remove either an external or internal discard route, use the **no** form of this command.

**discard-route** [**external** | **internal**]

**no discard-route** [**external** | **internal**]

## Syntax Description

| | |
|---|---|
| **external** | (Optional) Reinstalls the discard route entry for redistributed summarized routes on an Autonomous System Boundary Router (ASBR). |
| **internal** | (Optional) Reinstalls the discard-route entry for summarized internal routes on the Area Border Router (ABR). |

## Defaults

External and internal discard route entries are installed.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.1(1)T | This command was introduced. |

## Usage Guidelines

External and internal discard route entries are installed in routing tables by default. During route summarization, routing loops may occur when data is sent to a nonexisting network that appears to be a part of the summary, and the router performing the summarization has a less specific route (pointing back to the sending router) for this network in its routing table. To prevent the routing loop, a discard route entry is installed in the routing table of the ABR or ASBR.

If for any reason you do not want to use the external or internal discard route, remove the discard route by entering the no discard-route command with either the external or internal keyword.

## Examples

The following display shows the discard route functionality installed by default. When external or internal routes are summarized, a summary route to Null0 will appear in the router output from the **show ip route** command. See the router output lines that appear in bold font:

```
Router# show ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route
```

```
Gateway of last resort is not set

      172.16.0.0/24 is variably subnetted, 3 subnets, 2 masks
C        172.16.0.128/25 is directly connected, Loopback1
O        172.16.0.0/24 is a summary, 00:00:14, Null0
C        172.16.0.0/25 is directly connected, Loopback0
      172.31.0.0/24 is variably subnetted, 3 subnets, 2 masks
C        172.31.0.128/25 is directly connected, Loopback3
O        172.31.0.0/24 is a summary, 00:00:02, Null0
C        172.31.0.0/25 is directly connected, Loopback2
C     192.168.0.0/24 is directly connected, Ethernet0/0

RouterB# show ip route ospf

      172.16.0.0/24 is variably subnetted, 3 subnets, 2 masks
O        172.16.0.0/24 is a summary, 00:00:29, Null0
      172.16.0.0/24 is variably subnetted, 3 subnets, 2 masks
O        201.0.0.0/24 is a summary, 00:00:17, Null0
```

When the **no discard-route** command with the **internal** keyword is entered, notice the following route change, indicated by the router output lines that appear in bold font:

```
RouterB# configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.
RouterB(config)# router ospf 1
RouterB(config-router)# no discard-route internal
RouterB(config-router)#end

RouterB# show ip route ospf

      172.31.0.0/24 is variably subnetted, 3 subnets, 2 masks
O        172.16.0.0/24 is a summary, 00:04:14, Null0
```

Next, the **no discard-route** command with the **external** keyword is entered to remove the external discard route entry:

```
RouterB# configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.
RouterB(config)# router ospf 1
RouterB(config-router)# no discard-route external
RouterB(config-router)# end
```

The following router output from the **show running-config** command confirms that both the external and internal discard routes have been removed from the routing table of RouterB. See the router output lines that appear in bold font:

```
RouterB# show running-config

Building configuration...

Current configuration : 1114 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname RouterB
.
.
.
```

```
router ospf 1
  log-adjacency-changes
 no discard-route external
 no discard-route internal
 area 1 range 172.16.0.0 255.255.255.0
 summary-address 172.31.0.0 255.255.255.0
 redistribute rip subnets
 network 192.168.0.0 0.0.0.255 area 0
 network 172.16.0.0 0.0.0.255 area 1
!
```

## Related Commands

| Command | Description |
|---|---|
| **show ip route** | Displays the current state of the routing table. |
| **show running-config** | Displays the contents of the currently running configuration file or the configuration for a specific interface, or map class information. |

# 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** *dist1* | (Optional) Sets the distance for all routes within an area. The default value is 110. |
| **inter-area** *dist2* | (Optional) Sets the distance for all routes from one area to another area. The default value is 110. |
| **external** *dist3* | (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 Configuration

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

### Router B Configuration

```
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. |

# domain-tag

To set the Open Shortest Path First (OSPF) domain tag value for Type-5 or Type-7 link-state advertisements (LSAs) when OSPF is used as a protocol between a provider edge (PE) router and customer edge (CE) router, use the **domain-tag** command in router configuration mode. To reinstate the default tag value, use the **no** form of this command.

**domain-tag** *tag-value*

**no domain-tag** *tag-value*

## Syntax Description

| | |
|---|---|
| *tag-value* | Tag value. A 32-bit value entered in decimal format. The default value is calculated based on the Border Gateway Protocol (BGP) autonomous system (AS) number of the Multiprotocol Label Switching (MPLS) Virtual Private Network (VPN) backbone. The four highest bits are set to 1101 according to RFC 1745. The lowest 16 bits map the BGP AS number of the MPLS VPN backbone. If a user specifies the *tag-value*, the value does not have to follow any particular format. |

## Defaults

The default value is calculated based on the BGP autonomous system number of the MPLS VPN backbone. The four highest bits are set to 1101 according to RFC 1745. The lowest 16 bits map the BGP autonomous system number of the MPLS VPN backbone.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.1(7) | The command was introduced. |
| 12.1(7)E | The command was integrated into Cisco IOS Release 12.1(7)E. |
| 12.1(7)EC | The command was integrated into Cisco IOS Release 12.1(7)EC. |
| 12.0(17)ST | This command was integrated into Cisco IOS Release 12.0(17)ST. |
| 12.2(2)B | The command was integrated into Cisco IOS Release 12.2(4)B. |
| 12.2(14)S | The command was integrated into Cisco IOS Release 12.2(14)S. |

## Usage Guidelines

When OSPF is used between a PE router and a CE router, BGP routes that come from the MPLS backbone are redistributed to OSPF. These redistributed routes can be announced in Type-3, Type-5, or Type-7 LSAs. If the redistribution of the BGP routes results in Type-5 or Type-7 LSAs, the External Route Tag will be set to the value of the tag. If another PE router receives a Type-5 or Type-7 LSA with an External Route Tag equal to the set tag value, it will ignore the LSA, therefore preventing the redistributed routes that originated from the MPLS backbone from returning via some other location on the MPLS backbone.

## Examples

The following example configures the tag value 777:

```
Router(config)# router ospf 10 vrf grc
Router(config-router)# domain-tag 777
```

The **show ip ospf database** command is entered to verify that the tag value 777 has been applied to the External Route Tag:

```
Router# show ospf database external 192.168.50.1

            OSPF Router with ID (192.168.239.66) (Process ID 10)

               Type-5 AS External Link States

  LS age: 18
  Options: (No TOS-capability, DC)
  S Type: AS External Link
  Link State ID: 192.168.238.1 (External Network Number )
  Advertising Router: 192.168.239.66
  LS Seq Number: 80000002
  Checksum: 0xDAB0
  Length: 36
  Network Mask: /32
        Metric Type: 2 (Larger than any link state path)
        TOS: 0
        Metric: 1
        Forward Address: 0.0.0.0
        External Route Tag: 777
.
.
.
              OSPF Router with ID (198.168.237.56) (Process ID 1)
```

## Related Commands

| Command | Description |
|---|---|
| **show ospf database** | Displays lists of information related to the OSPF database for a specific router. |

# ignore lsa mospf

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

**ignore lsa mospf**

**no 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 packets, 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
 ignore lsa mospf
```

# 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 the OSPF 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

| | |
|---|---|
| *password* | 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 authentication** | Specifies authentication type for an interface. |

# 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** *interface-cost*

**no ip ospf cost** *interface-cost*

## Syntax Description

| | |
|---|---|
| *interface-cost* | Unsigned integer value expressed as the link-state metric. It can be a value in the range from 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:

$10^8$ / 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 64
- 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
- X25—Default cost is 5208
- Asynchronous—Default cost is 10,000

- ATM— Default cost is 1

**Examples**

The following example sets the interface cost value to 65:

```
ip ospf cost 65
```

# ip ospf database-filter all out

To filter outgoing link-state advertisements (LSAs) to an OSPF interface, use the **ip ospf database-filter all out** 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 the interval at which hello packets must not be seen before 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

| | |
|---|---|
| *seconds* | 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 router 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 hello messages are suppressed and periodic refreshes of link-state advertisements (LSAs) do not flood the demand circuit. This command allows the underlying data link layer to be closed when the topology is stable. In point-to-multipoint topology, only the multipoint end must configured with this command.

## Examples

The following example sets the configuration for an ISDN on-demand circuit:

```
router ospf 1
 network 10.0.3.0 255.255.255.0 area 0
interface BRI0
 ip ospf demand-circuit
```

# ip ospf flood-reduction

To suppress the unnecessary flooding of link-state advertisements (LSAs) in stable topologies, use the **ip ospf flood-reduction** command in interface configuration mode. To disable this feature, use the **no** form of this command.

**ip ospf flood-reduction**

**no ip ospf flood-reduction**

## Syntax Description

This command has no arguments or keywords.

## Defaults

This command is disabled by default.

## Command Modes

Interface configuration

## Command History

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

## Usage Guidelines

All routers supporting the OSPF demand circuit are compatible and can interact with routers supporting flooding reduction.

## Examples

The following example reduces the flooding of unnecessary LSAs on serial interface 0:

```
interface serial 0
 ip ospf flood-reduction
```

## Related Commands

| Command | Description |
|---|---|
| **show ip ospf interface** | Displays OSPF-related interface information. |
| **show ip ospf neighbor** | Displays OSPF-neighbor information on a per-interface basis. |

# 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

| | |
|---|---|
| *seconds* | Specifies the interval (in seconds). The value must be the same for all nodes on a specific network. |

## Defaults

10 seconds (Ethernet)

30 seconds (nonbroadcast)

## 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 Message Digest 5 (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** *key-id* **md5** *key*

**no ip ospf message-digest-key** *key-id*

## Syntax Description

| | |
|---|---|
| *key-id* | An identifier in the range from 1 to 255. |
| *key* | 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.

**Note** If the **service password-encryption** command is not used when implementing OSPF MD5 authentication, the MD5 secret will be stored as plain text in NVRAM.

## Examples

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

```
interface ethernet 1
 ip ospf message-digest-key 10 md5 xvv560qle
 ip ospf message-digest-key 19 md5 8ry4222
```

## Related Commands

| Command | Description |
|---|---|
| **area authentication** | Enables authentication for an OSPF area. |
| **ip ospf authentication** | Specifies authentication type for an interface. |
| **service password-encryption** | Encrypts a password. |

# ip ospf mtu-ignore

To disable OSPF MTU mismatch detection on receiving DBD packets, use the **ip ospf mtu-ignore** command in interface configuration mode. To reset to default, use the **no** form of this command.

**ip ospf mtu-ignore**

**no ip ospf mtu-ignore**

## Syntax Description

This command has no keywords or arguments.

## Defaults

OSPF MTU mismatch detection is enabled.

## Command Modes

Interface configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(3) | This command was introduced. |

## Usage Guidelines

OSPF checks whether neighbors are using the same MTU on a common interface. This check is performed when neighbors exchange Database Descriptor (DBD) packets. If the receiving MTU in the DBD packet is higher than the IP MTU configured on the incoming interface, OSPF adjacency will not be established.

## Examples

The following example disables MTU mismatch detection on receiving DBD packets:

```
interface serial 0/0
 ip ospf mtu-ignore
```

# 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 the router 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 medium, 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**] | **point-to-point**}}

**no ip ospf network**

## Syntax Description

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

## 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 NBMA networks when, for example, routers in your network do not support multicast addressing. You can also configure nonbroadcast multiaccess networks (such as X.25, Frame Relay, and Switched Multimegabit Data Service (SMDS)) as broadcast networks. This feature saves you from needing 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 networks. However, there are other configurations where this assumption is not true. For example, 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 need not configure neighbors when using this feature.

If this command is issued on an interface that does not allow it, this command 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 192.168192.168.77.17 255.255.255.0
 ip ospf network broadcast
 encapsulation frame-relay
```

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

```
interface serial 0
 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-value*

**no ip ospf priority** *number-value*

## Syntax Description

| | |
|---|---|
| *number-value* | A number value that specifies the priority of the router. 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 (LSA) 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

| | |
|---|---|
| *seconds* | Time (in seconds) between retransmissions. It must be greater than the expected round-trip delay between any two routers on the attached network. The range is from 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

When a router sends an LSA to its neighbor, it keeps the LSA until it receives back the acknowledgment message. If the router receives no acknowledgment, it will resend the LSA.

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

## 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 required to send 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

| | |
|---|---|
| *seconds* | Time (in seconds) required to send a link-state update. The range is from 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 (LSAs) in the update packet must have their ages incremented by the amount specified in the *seconds* argument before transmission. The value assigned should take into account the transmission and propagation delays for the interface.

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

## Examples

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

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

# log-adjacency-changes

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

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

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

## Syntax Description

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

## Defaults

Enabled

## Command Modes

Router configuration

## Command History

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

## Usage Guidelines

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

## Examples

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

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

# neighbor (OSPF)

To configure OSPF routers interconnecting to nonbroadcast networks, use 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*] [**database-filter all**]

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

## Syntax Description

| | |
|---|---|
| *ip-address* | Interface IP address of the neighbor. |
| **priority** *number* | (Optional) A number that indicates 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) A number value that represents the poll interval time (in seconds). 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. For point-to-multipoint interfaces, the cost keyword and the *number* argument are the only options that are applicable. This keyword does not apply to nonbroadcast multiaccess (NBMA) networks. |
| **database-filter all** | (Optional) Filters outgoing link-state advertisements (LSAs) to an OSPF neighbor. |

## 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. Refer to the **x25 map** and **frame-relay map** commands in the "X.25 Commands" and "Frame Relay Commands" chapters, respectively, in the *Cisco IOS 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 must be on the primary address of the interface.

If a neighboring router has become inactive (hello packets have not been received 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 nonzero priority, that is, routers that are eligible to become designated routers (DRs) and backup designated routers (BDRs). After the 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 Cisco IOS 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 link-state advertisements (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

| | |
|---|---|
| *ip-address* **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 all out** | 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** *ip-address wildcard-mask* **area** *area-id*

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

## Syntax Description

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

For OSPF to operate on the interface, the primary address of the interface 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 *ip-address* s *wildcard-mask* pair for each interface as follows:

1. The *wildcard-mask* argument is logically ORed with the interface IP address.
2. The *wildcard-mask* argument is logically ORed with the *ip-address* argument in the **network** command.
3. The software compares the two resulting values. 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, we recommend that you configure address ranges that do not overlap in order to avoid inadvertent conflicts.

When a more specific OSPF network range is removed, interfaces belonging to that network range will be retained and remain active if and only if a less specific network range exists.

For example, consider the following configuration:

```
router ospf 1
 network 205.188.129.16 0.0.0.3 area 20
 network 205.188.129.40 0.0.0.3 area 20
 network 205.188.129.44 0.0.0.3 area 20
 network 205.188.129.96 0.0.0.3 area 20
 network 205.188.128.0  0.0.127.255 area 20
!
```

Enter the following:

```
no network 205.188.129.40 0.0.0.3 area 20
```

Interfaces falling into the network range 205.188.129.40/0.0.0.3 will still remain active because the superset, 205.188.128.0/0.0.127.255, exists for area 20. A more specific network statement will cause interfaces belonging to that range to be removed from a different area only if a less specific network statement (superset) exists.

Consider a configuration such as the following:

```
!
router ospf 1
 network 205.188.128.0 0.0.127.255 area 20
!
```

If the following network statement is entered:

```
network 205.188.129.96 0.0.0.3 area 40
```

then interfaces belonging to range 205.188.129.96/0.0.0.3, if any, are removed from area 20 and moved to area 40. Network statements with identical ranges but with different area IDs are considered as area changes. For example, the following network statements will cause interfaces belonging to network range 205.188.129.40/0.0.0.3 to move from area 20 to area 40:

```
network 205.188.129.40 0.0.0.3 area 20
network 205.188.129.40 0.0.0.3 area 40
```

## 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. |

# router-id

To use a fixed router ID, use the **router-id** command in router configuration mode. 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** *ip-address*

## Syntax Description

| | |
|---|---|
| *ip-address* | Router ID in IP address format. |

## Defaults

No OSPF routing process is defined.

## Command Modes

Router configuration

## Command History

| Release | Modification |
|---|---|
| 12.0(1)T | 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 |
|---|---|
| **clear ip ospf** | Clears redistribution based on the OSPF routing process ID. |
| **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

| | |
|---|---|
| *process-id* | Internally used identification parameter for an OSPF routing process. It is locally assigned and can be any positive integer. A unique value is assigned for each OSPF routing process. |
| **vrf** *vpn-name* | (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 *vpn-name* arguments were added to identify a VPN. |
| 12.0(9)ST | The **vrf** keyword and *vpn-name* arguments were added. |

## Usage Guidelines

You can specify multiple OSPF routing processes in each router.

After you enter the **router ospf** command, you can enter the maximum number of paths. There can be from 1 to 32 paths.

## 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
```

The following example shows usage of the **maximum-paths** option:

```
Router> enable
Router# configure terminal
Router(config)# router ospf
Router(config-router)# maximum-paths?
Router(config)# 20
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

| | |
|---|---|
| *process-id* | (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 5 describes the significant fields shown in the display.

***Table 5 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 | Specifies summary update interval in hours:minutes:seconds, and time until next update. |

*Table 5 show ip ospf Field Descriptions (continued)*

| Field | Description |
|---|---|
| External Link update interval | Specifies external update interval in hours:minutes:seconds, and time until 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 | Specifies router and network link-state update interval in hours:minutes:seconds, and time until next update. |
| Link State Age Interval | Specifies 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

Codes:  i - Intra-area route, I - Inter-area route

i 192.168.97.53   [10] via 172.16.1.53,   Serial0, ABR,  Area 0.0.0.3, SPF 3
i 192.168.103.51  [10] via 192.168.96.51, Serial0, ABR,  Area 0.0.0.3, SPF 3
I 192.168.103.52  [22] via 192.168.96.51, Serial0, ASBR, Area 0.0.0.3, SPF 3
I 192.168.103.52  [22] via 172.16.1.53,   Serial0, ASBR, Area 0.0.0.3, SPF 3
```

Table 6 describes the significant fields shown in the display.

***Table 6 show ip ospf border-routers Field Descriptions***

| Field | Description |
|---|---|
| 192.168.97.53 | Router ID of the destination. |
| [10] | Cost of using this route. |
| via 172.16.1.53 | Next hop toward the destination. |
| Serial0 | Interface type for the outging interface. |
| ABR | The router type of the destination; it is either an ABR or ASBR or both. |
| Area | The area ID of the area from which this route is learned. |
| SPF 3 | The internal number of the shortest path first (SPF) calculation that installs this route. |

# show ip ospf database

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

**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* [*area-id*]] **database** [**external**] [*link-state-id*]

**show ip ospf** [*process-id* [*area-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** [**opaque-area**] [*link-state-id*]

**show ip ospf** [*process-id* [*area-id*]] **database** [**opaque-area**] [*link-state-id*] [**adv-router** [*ip-address*]]

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

**show ip ospf** [*process-id* [*area-id*]] **database** [**opaque-as**] [*link-state-id*]

**show ip ospf** [*process-id* [*area-id*]] **database** [**opaque-as**] [*link-state-id*] [**adv-router** [*ip-address*]]

**show ip ospf** [*process-id* [*area-id*]] **database** [**opaque-as**] [*link-state-id*] [**self-originate**] [*link-state-id*]

**show ip ospf** [*process-id* [*area-id*]] **database** [**opaque-link**] [*link-state-id*]

**show ip ospf** [*process-id* [*area-id*]] **database** [**opaque-link**] [*link-state-id*] [**adv-router** [*ip-address*]]

**show ip ospf** [*process-id* [*area-id*]] **database** [**opaque-link**] [*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

| | |
|---|---|
| *process-id* | (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. |
| *area-id* | (Optional) Area number associated with the OSPF address range defined in the **network** router configuration command used to define the particular area. |
| **adv-router** [*ip-address*] | (Optional) Displays all the link-state advertisements (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 the **self-originate** keyword). |
| **asbr-summary** | (Optional) Displays information only about the Autonomous System Boundary Router (ASBR) summary LSAs. |
| *link-state-id* | (Optional) Portion of the Internet environment that is being described by the advertisement. The value entered depends on the type of the LSA. The value must be entered in the form of an IP address.<br><br>When the LSA is describing a network, the *link-state-id* argument can take one of two forms:<br><br>• The network IP address (as in Type 3 summary link advertisements and in autonomous system external link advertisements).<br><br>• A derived address obtained from the link-state ID. (Note that masking a network will link the advertisement link-state ID with the network subnet mask yielding the network IP address.)<br><br>When the LSA is describing a router, the link-state ID is always the OSPF router ID of the described router.<br><br>When an autonomous system external advertisement (Type 5) is describing a default route, its link-state ID is set to the default destination (0.0.0.0). |
| **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 not so stubby area (NSSA) external LSAs. |
| **opaque-area** | (Optional) Displays information about the opaque Type 10 LSAs. Type 10 denotes an area-local scope. Refer to RFC 2370 for more information on the opaque LSA options. |
| **opaque-as** | (Optional) Displays information about the opaque Type 11 LSAs. Type 11 denotes that the LSA is flooded throughout the autonomous system. |
| **opaque-link** | (Optional) Displays information about the opaque Type 9 LSAs. Type 9 denotes a link-local scope. |
| **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. |
| 11.0 | The **database-summary** keyword was added. |
| 12.0 | The following keywords were added:<br>• **self-originate**<br>• **adv-router** |
| 12.1 | The following keywords were added:<br>• **opaque-area**<br>• **opaque-as**<br>• **opaque-link** |

## 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(192.168.1.11) (Process ID 1)

                Router Link States(Area 0)

 Link ID           ADV Router        Age         Seq#       Checksum Link count
 192.168.1.8       192.168.1.8       1381      0x8000010D    0xEF60   2
 192.168.1.11      192.168.1.11      1460      0x800002FE    0xEB3D   4
 192.168.1.12      192.168.1.12      2027      0x80000090    0x875D   3
 192.168.1.27      192.168.1.27      1323      0x800001D6    0x12CC   3

                Net Link States(Area 0)

 Link ID         ADV Router        Age         Seq#       Checksum
 172.16.1.27      192.168.1.27      1323      0x8000005B    0xA8EE
 172.17.1.11      192.168.1.11      1461      0x8000005B    0x7AC

                Type-10 Opaque Link Area Link States (Area 0)

  Link ID         ADV Router        Age         Seq#       Checksum Opaque ID
 10.0.0.0         192.168.1.11      1461      0x800002C8    0x8483     0
 10.0.0.0         192.168.1.12      2027      0x80000080    0xF858     0
 10.0.0.0         192.168.1.27      1323      0x800001BC    0x919B     0
 10.0.0.1         192.168.1.11      1461      0x8000005E    0x5B43     1
```

Table 7 describes the significant fields shown in the display.

***Table 7 show ip ospf database Field Descriptions***

| Field | Description |
|---|---|
| Link ID | Router ID number. |
| ADV Router | Advertising router ID. |
| Age | Link-state age. |
| Seq# | Link-state sequence number (detects old or duplicate LSAs). |
| Checksum | Fletcher checksum of the complete contents of the LSA. |

*Table 7 show ip ospf database Field Descriptions (continued)*

| Field | Description |
|---|---|
| Link count | Number of interfaces detected for router. |
| Opaque ID | Opaque LSA ID number. |

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 8 describes the significant fields shown in the display.

*Table 8 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 (ASBR). |
| Advertising Router | Advertising router ID. |
| LS Seq Number | Link-state sequence (detects old or duplicate LSAs). |
| Checksum | Link-state checksum (Fletcher checksum of the complete contents of the LSA). |
| Length | Length in bytes of the LSA. |
| 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: 143.10.0.0 (External Network Number)
Advertising Router: 10.187.70.6
LS Seq Number: 80000AFD
Checksum: 0xC3A
Length: 36
Network Mask: 255.255.0.0
     Metric Type: 2 (Larger than any link state path)
     TOS: 0
     Metric: 1
     Forward Address: 0.0.0.0
     External Route Tag: 0
```

Table 9 describes the significant fields shown in the display.

***Table 9 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 ID. |
| LS Seq Number | Link-state sequence number (detects old or duplicate LSAs). |
| Checksum | Checksum (Fletcher checksum of the complete contents of the LSA). |
| Length | Length in bytes of the LSA. |
| 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 to the originator of the advertisement. |
| 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: 10.187.1.3 (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: 10.187.241.5
        Attached Router: 10.187.1.1
        Attached Router: 10.187.54.5
        Attached Router: 10.187.1.5
```

Table 10 describes the significant fields shown in the display.

***Table 10 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 ID. |
| LS Seq Number | Link-state sequence (detects old or duplicate LSAs). |
| Checksum | Checksum (Fletcher checksum of the complete contents of the LSA). |
| 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, carrying Multiprotocol Label Switching (MPLS) traffic engineering specification information, from the **show ip ospf database** command with the **opaque-area** keyword:

```
Router# show ip ospf database opaque-area adv-router 192.168.1.12

OSPF Router with id(192.168.1.11) (Process ID 1)

                Type-10 Opaque Link Area Link States (Area 0)

LS age: 224
   Options: (No TOS-capability, DC)
   LS Type: Opaque Area Link
   Link State ID: 1.0.0.0
   Opaque Type: 1
   Opaque ID: 0
   Advertising Router: 192.168.1.12
   LS Seq Number: 80000081
   Checksum: 0xF659
   Length: 132
   Fragment number : 0

     MPLS TE router ID : 192.168.1.12

     Link connected to Point-to-Point network
       Link ID : 192.168.1.11
       Interface Address : 172.16.1.12
       Neighbor Address : 172.16.1.11
       Admin Metric : 10
       Maximum bandwidth : 193000
       Maximum reservable bandwidth : 125000
       Number of Priority : 8
       Priority 0 : 125000      Priority 1 : 125000
       Priority 2 : 125000      Priority 3 : 125000
       Priority 4 : 125000      Priority 5 : 125000
       Priority 6 : 125000      Priority 7 : 100000
       Affinity Bit : 0x0

     Number of Links : 1
```

Table 11 describes the significant fields shown in the display.

***Table 11 show ip ospf database opaque-area 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. |
| Opaque Type | Opaque link-state type. |
| Opaque ID | Opaque ID number. |
| Advertising Router | Advertising router ID. |
| LS Seq Number | Link-state sequence (detects old or duplicate LSAs). |
| Checksum | Checksum (Fletcher checksum of the complete contents of the LSA). |

*Table 11 show ip ospf database opaque-area Field Descriptions (continued)*

| Field | Description |
|---|---|
| Length | Length in bytes of the LSA. |
| Fragment number | Arbitrary value used to maintain multiple traffic engineering LSAs. |
| Link ID | Link ID number. |
| Interface Address | ID address of the interface. |
| Neighbor Address | IP address of the neighbor. |
| Admin Metric | Administrative distance metric value used by Multiprotocol Label Switching traffic engineering (MPLS-TE). |
| Maximum bandwidth | Specifies maximum bandwidth. |
| Maximum reservable bandwidth | Specifies maximum reservable bandwidth. |
| Number of Priority | Priority number. |
| Affinity Bit | Used by MPLS-TE. |

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: 10.187.21.6
Advertising Router: 10.187.21.6
LS Seq Number: 80002CF6
Checksum: 0x73B7
Length: 120
AS Boundary Router
155   Number of Links: 8

Link connected to: another Router (point-to-point)
(link ID) Neighboring Router ID: 10.187.21.5
(Link Data) Router Interface address: 10.187.21.6
Number of TOS metrics: 0
TOS 0 Metrics: 2
```

Table 12 describes the significant fields shown in the display.

*Table 12 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). |

*Table 12 show ip ospf database router Field Descriptions (continued)*

| Field | Description |
|---|---|
| LS Type | Link-state type. |
| Link State ID | Link-state ID. |
| Advertising Router | Advertising router ID. |
| LS Seq Number | Link-state sequence (detects old or duplicate LSAs). |
| Checksum | Checksum (Fletcher checksum of the complete contents of the LSA). |
| Length | Length in bytes of the LSA. |
| 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: 10.187.240.0 (summary Network Number)
Advertising Router: 10.187.241.5
LS Seq Number: 80000072
Checksum: 0x84FF
Length: 28
Network Mask: 255.255.255.0   TOS: 0  Metric: 1
```

Table 13 describes the significant fields shown in the display.

*Table 13 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 | The ID of the advertising router. |
| LS Seq Number | Link-state sequence (detects old or duplicate LSAs). |
| Checksum | Checksum (Fletcher checksum of the complete contents of the LSA). |
| Length | Length in bytes of the link-state advertisement. |

*Table 13 show ip ospf database summary Field Descriptions (continued)*

| Field | Description |
|---|---|
| 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                                            0           0         0
Total       1         0          0          0           1
```

Table 14 describes the significant fields shown in the display.

*Table 14 show ip ospf database database-summary Field Descriptions*

| Field | Description |
|---|---|
| Area ID | Area number. |
| Router | Number of router LSAs in that area. |
| Network | Number of network LSAs in that area. |
| Sum-Net | Number of summary LSAs in that area. |
| Sum-ASBR | Number of summary ASBR LSAs in that area. |
| Subtotal | Sum of Router, Network, Sum-Net, and Sum-ASBR for that area. |
| Delete | Number of LSAs that are marked “Deleted” in that area. |
| Maxage | Number of LSAs that are marked “Maxaged” in that area. |
| AS External | Number of external LSAs. |

# show ip ospf flood-list

To display a list of OSPF link-state advertisements (LSAs) waiting to be flooded over an interface, use the **show ip ospf flood-list** command in EXEC mode.

**show ip ospf flood-list** *interface-type interface-number*

## Syntax Description

| | |
|---|---|
| *interface-type* | Interface type over which the LSAs will be flooded. |
| *interface-number* | Interface number over which the LSAs will be flooded. |

## Command Modes

EXEC

## Command History

| Release | Modification |
|---|---|
| 12.0(1)T | This command was introduced. |

## Usage Guidelines

Use this command to observe OSPF packet pacing.

## Examples

The following is sample output of the **show ip ospf flood-list** command:

```
Router# show ip ospf flood-list ethernet 1

 Interface Ethernet1, Queue length 20
 Link state flooding due in 12 msec

 Type  LS ID            ADV RTR           Seq NO      Age    Checksum
    5  10.2.195.0       192.168.0.163     0x80000009  0      0xFB61
    5  10.1.192.0       192.168.0.163     0x80000009  0      0x2938
    5  10.2.194.0       192.168.0.163     0x80000009  0      0x757
    5  10.1.193.0       192.168.0.163     0x80000009  0      0x1E42
    5  10.2.193.0       192.168.0.163     0x80000009  0      0x124D
    5  10.1.194.0       192.168.0.163     0x80000009  0      0x134C
```

Table 15 describes the significant fields shown in the display.

***Table 15 show ip ospf flood-list Field Descriptions***

| Field | Description |
|---|---|
| Interface Ethernet1 | Interface for which information is displayed. |
| Queue length | Number of LSAs waiting to be flooded. |
| Link state retransmission due in | Length of time before next link-state transmission. |
| Type | Type of LSA. |
| LS ID | Link-state ID of the LSA. |
| ADV RTR | IP address of advertising router. |
| Seq NO | Sequence number of LSA. |

*Table 15 show ip ospf flood-list Field Descriptions (continued)*

| Field | Description |
|---|---|
| Age | Age of LSA (in seconds). |
| Checksum | Checksum of LSA. |

# show ip ospf interface

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

**show ip ospf interface** [*interface-type interface-number*]

## Syntax Description

| | |
|---|---|
| *interface-type* | (Optional) Interface type. |
| *interface-number* | (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 interface 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 16 describes the significant fields shown in the display.

***Table 16 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 16 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** [*interface-type interface-number*] [*neighbor-id*] [**detail**]

## Syntax Description

| | |
|---|---|
| *interface-type* | (Optional) Interface type. |
| *interface-number* | (Optional) Interface number. |
| *neighbor-id* | (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 192.168.5.2, interface address 10.225.200.28
    In the area 0 via interface Ethernet1
    Neighbor priority is 1, State is FULL, 6 state changes
    DR is 10.225.200.28 BDR is 10.225.200.30
    Options is 0x42
    Dead timer due in 00:00:36
    Neighbor is up for 00:09:46
   Index 1/1, retransmission queue length 0, number of retransmission 1
    First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
    Last retransmission scan length is 1, maximum is 1
    Last retransmission scan time is 0 msec, maximum is 0 msec
```

Table 17 describes the significant fields shown in the displays.

***Table 17 show ip ospf neighbor detail Field Descriptions***

| Field | Description |
|---|---|
| Neighbor | Neighbor router ID. |
| interface address | IP address of the interface. |
| In the area | Area and interface through which the OSPF neighbor is known. |
| Neighbor priority | Router priority of the neighbor, neighbor state. |
| State | OSPF state. |
| state changes | Number of state changes since the neighbor was created.This value can be reset using the **clear ip ospf counters neighbor** command. |
| DR is | Router ID of the designated router for the interface. |
| BDR is | Router ID of the backup designated router for the interface. |
| 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 the neighbor dead. |

*Table 17 show ip ospf neighbor detail Field Descriptions (continued)*

| Field | Description |
|---|---|
| Neighbor is up for | Number of hours:minutes:seconds since the neighbor went into 2-way state. |
| Index | Neighbor location in the area-wide and autonomous system-wide retransmission queue. |
| retransmission queue length | Number of elements in retransmission queue. |
| number of retransmission | Number of times update packets have been retransmitted during flooding. |
| First | Memory location of the flooding details. |
| Next | Memory location of the flooding details. |
| Last retransmission scan length | Number of LSAs in the last retransmission packet. |
| maximum | Maximum number of LSAs sent in any retransmission packet. |
| Last retransmission scan time | Time taken to build last retransmission packet. |
| maximum | Maximum time taken to build any retransmission packet. |

# 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** [*neighbor*] [*interface*] [*interface-neighbor*]

## Syntax Description

| | |
|---|---|
| *neighbor* | (Optional) Displays the list of all LSAs requested by the router from this neighbor. |
| *interface* | (Optional) Displays the list of all LSAs requested by the router from this interface. |
| *interface-neighbor* | (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 serial 0

             OSPF Router with ID (192.168.1.11) (Process ID 1)

  Neighbor 192.168.1.12, interface Serial0 address 172.16.1.12

  Type  LS ID             ADV RTR          Seq NO      Age    Checksum
     1  192.168.1.12      192.168.1.12     0x8000020D  8      0x6572
```

# show ip ospf retransmission-list

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

**show ip ospf retransmission-list** [*neighbor*] [*interface*] [*interface-neighbor*]

## Syntax Description

| | |
|---|---|
| *neighbor* | (Optional) Displays the list of all LSAs waiting to be resent for this neighbor. |
| *interface* | (Optional) Displays the list of all LSAs waiting to be resent on this interface. |
| *interface-neighbor* | (Optional) Displays the list of all LSAs waiting to be resent 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 serial 0

            OSPF Router with ID (192.168.1.12) (Process ID 1)

  Neighbor 192.168.1.11, 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  192.168.1.12      192.168.1.12     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

| | |
|---|---|
| *process-id* | (Optional) OSPF area ID. |

## Command Modes

EXEC

## Command History

| Release | Modification |
|---|---|
| 10.0 | This command was introduced. |

## Usage Guidelines

The *process-id* argument 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 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 18 describes the significant fields shown in the display.

***Table 18 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. |
| 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)

To create aggregate addresses for OSPF, use the **summary-address** command in router configuration mode. To restore the default, use the **no** form of this command.

**summary-address {{***ip-address mask***} | {***prefix mask***}}** [**not-advertise**] [**tag** *tag*]

**no summary-address {{***ip-address mask* **} | {***prefix mask***}}** [**not-advertise**] [**tag** *tag*]

## Syntax Description

| | |
|---|---|
| *ip-address* | Summary address designated for a range of addresses. |
| *mask* | IP subnet mask used for the summary route. |
| *prefix* | IP route prefix for the destination. |
| *mask* | IP subnet mask used for the summary route. |
| **not-advertise** | (Optional) Suppress routes that match the specified 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.

OSPF does not support **summary-address 0.0.0.0 0.0.0.0**.

## Examples

In the following example, the summary address 10.1.0.0 includes address 10.1.1.0, 10.1.2.0, 10.1.3.0, and so on. 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-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. |

# timers lsa-group-pacing

To change the interval at which OSPF link-state advertisements (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

| | |
|---|---|
| *seconds* | Number of seconds in the interval at which LSAs are grouped and refreshed, checksummed, or aged. The range is from 10 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 about 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

| | |
|---|---|
| *spf-delay* | Delay time (in seconds) between when OSPF receives a topology change and when it starts an SPF calculation. It can be an integer from 0 to 65535. The default time is 5 seconds. A value of 0 means that there is no delay; that is, the SPF calculation is started immediately. |
| *spf-holdtime* | Minimum time (in seconds) between two consecutive SPF calculations. It can be an integer from 0 to 65535. The default time is 10 seconds. A value of 0 means that there is no delay; that is, two 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 requires the router to use 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
```