OSPF Support for MTR

The OSPF Support for MTR feature provides Open Shortest Path First (OSPF) support for multiple logical topologies over a single physical network. This module describes how to configure OSPF for Multitopology Routing (MTR).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for OSPF Support for MTR

- Be familiar with the concepts documented in the" Routing Protocol Support for MTR" section.
- Configure and activate a global topology configuration.
- Check your Open Shortest Path First (OSPF) device configuration and enter the topology-aware device configuration commands in router address family configuration mode.

- Several OSPF configuration commands need to be topology-aware. Before you configure OSPF Multitopology Routing (MTR), you need to enter the following commands in router address family configuration mode if they are used in your original OSPF device configuration.

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

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

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

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

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

  - **area** *transit-area-id* **virtual-link** *transit-router-id* **topology disable**

  - **default-information originate** [**always**] [**metric** *metric-value*] [**metric-type** *type-value*] [**route-map** *map-name*]

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

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

  - **distance ospf** {**external** *dist1* | **inter-area** *dist2* | **intra-area** *dist3*}

  - **distribute-list in**

  - **distribute-list out**

  - **max-metric router-lsa** [**on-startup** {*seconds* | **wait-for-bgp**}]

  - **maximum-paths** *number-of-paths*

  - **neighbor** *ip-address* [**cost** *number*]

  - **redistribute** *protocol* [*process-id*] {**level-1** | **level-1-2** | **level-2**} [*as-number*] [**metric** {*metric-value* | **transparent**}] [*metric-type type-value*] [**match** {**external** | **internal** | **nssa-external**}] [**tag** *tag-value*] [**route-map** *map-tag*] [**subnets**]

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

  - **timers throttle spf** *spf-start spf-hold spf-max-wait*

  - **traffic-share min across-interfaces**

Information About OSPF Support for MTR

Routing Protocol Support for MTR

You must enable IP routing on the device for Multitopology Routing (MTR) to operate. MTR supports static and dynamic routing in Cisco software. You can enable dynamic routing per topology to support interdomain and intradomain routing. Route calculation and forwarding are independent for each topology. MTR support is integrated into Cisco software for the following protocols:

- Border Gateway Protocol (BGP)

- Enhanced Interior Gateway Routing Protocol (EIGRP)

- Integrated Intermediate System-to-Intermediate System (IS-IS)

- Open Shortest Path First (OSPF)

You apply the per-topology configuration in router address family configuration mode of the global routing process (router configuration mode). The address family and subaddress family are specified when the device enters address family configuration mode. You specify the topology name and topology ID by entering the **topology** command in address family configuration mode.

You configure each topology with a unique topology ID under the routing protocol. The topology ID is used to identify and group Network Layer Reachability Information (NLRI) for each topology in updates for a given protocol. In OSPF, EIGRP, and IS-IS, you enter the topology ID during the first configuration of the **topology** command for a class-specific topology. In BGP, you configure the topology ID by entering the **bgp tid** command under the topology configuration.

You can configure class-specific topologies with different metrics than the base topology. Interface metrics configured on the base topology can be inherited by the class-specific topology. Inheritance occurs if no explicit inheritance metric is configured in the class-specific topology.

You configure BGP support only in router configuration mode. You configure Interior Gateway Protocol (IGP) support in router configuration mode and in interface configuration mode.

By default, interfaces are not included in nonbase topologies. For routing protocol support for EIGRP, IS-IS, and OSPF, you must explicitly configure a nonbase topology on an interface. You can override the default behavior by using the **all-interfaces** command in address family topology configuration mode. The **all-interfaces** command causes the nonbase topology to be configured on all interfaces of the device that are part of the default address space or the virtual routing and forwarding (VRF) instance in which the topology is configured.

Interface Configuration Support for MTR

The configuration of a Multitopology Routing (MTR) topology in interface configuration mode allows you to enable or disable MTR on a per-interface basis. By default, a class-specific topology does not include any interfaces.

You can include or exclude individual interfaces by configuring the **topology** interface configuration command. You specify the address family and the topology (base or class-specific) when entering this command. The subaddress family can be specified. If no subaddress family is specified, the unicast subaddress family is used by default.

You can include globally all interfaces on a device in a topology by entering the **all-interfaces** command in routing topology configuration mode. Per-interface topology configuration applied with the **topology** command overrides global interface configuration.

The interface configuration support for MTR has these characteristics:

- Per-interface routing configuration: Interior Gateway Protocol (IGP) routing and metric configurations can be applied in interface topology configuration mode. Per-interface metrics and routing behaviors can be configured for each IGP.

- Open Shortest Path First (OSPF) interface topology configuration: Interface mode OSPF configurations for a class-specific topology are applied in interface topology configuration mode. In this mode, you can configure an interface cost or disable OSPF routing without removing the interface from the global topology configuration.

- Enhanced Interior Gateway Routing Protocol (EIGRP) interface topology configuration: Interface mode EIGRP configurations for a class-specific topology are applied in interface topology configuration mode. In this mode, you can configure various EIGRP features.

- Intermediate System-to-Intermediate System (IS-IS) interface topology configuration: Interface mode IS-IS configurations for a class-specific topology are applied in interface topology configuration mode. In this mode, you can configure an interface cost or disable IS-IS routing without removing the interface from the global topology configuration.

How to Configure OSPF Support for MTR

Activating an MTR Topology by Using OSPF

Note Only Multitopology Routing (MTR) commands are shown in this task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospf** *process-id* [**vrf** *vrf-name*]
4. **address-family ipv4** [**multicast** | **unicast**]
5. **topology** {**base** | *topology-name* **tid** *number*}
6. **end**
7. **show ip ospf** [*process-id*] **topology-info** [**multicast**] [**topology** {*topology-name* | **base**}]

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**router ospf** *process-id* [**vrf** *vrf-name*] **Example:** Device(config)# router ospf 1	Enables an Open Shortest Path First (OSPF) routing process and enters router configuration mode.
Step 4	**address-family ipv4** [**multicast** | **unicast**] **Example:** Device(config-router)# address-family ipv4	Enters router address family configuration mode to configure an OSPF address family session. • Only the base topology can be configured under the multicast subaddress family.
Step 5	**topology** {**base** | *topology-name* **tid** *number*} **Example:** Device(config-router-af)# topology VOICE tid 10	Configures OSPF support for the topology and assigns a Topology Identifier (TID) number for each topology. • Enters router address family topology configuration mode. • Use the **tid** *number* keyword and argument to configure a topology ID. The topology ID must be configured in the first configuration of the specified topology. It is optional for subsequent configuration. **Note** The **base** keyword is accepted only for IPv4 multicast. The **tid** keyword is accepted only for IPv4 or IPv6 unicast.
Step 6	**end** **Example:** Device(config-router-af-topology)# end	Exits router address family topology configuration mode and returns to privileged EXEC mode.
Step 7	**show ip ospf** [*process-id*] **topology-info** [**multicast**] [**topology** {*topology-name* | **base**}] **Example:** Device# show ip ospf topology-info topology VOICE	(Optional) Displays OSPF information about the specified topology.

What to Do Next

If an Enhanced Interior Gateway Routing Protocol (EIGRP) topology configuration is required, see the "EIGRP Support for MTR" feature module.

If an Intermediate System-to-Intermediate System (IS-IS) topology configuration is required, see the "IS-IS Support for MTR" feature module.

Activating an MTR Topology in Interface Configuration Mode by Using OSPF

Before You Begin

Define a topology globally before performing the per-interface topology configuration.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **topology ipv4** [**multicast** | **unicast**] {*topology-name* [**disable**] | **base**}
5. **ip ospf cost** *number*
6. **ip ospf topology disable**
7. **end**
8. **show ip ospf** [*process-id*] **interface** [*type number*] [**brief**] [**multicast**] [**topology** {*topology-name* | **base**}]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface Ethernet 0/0`	Specifies the interface type and number, and enters interface configuration mode.
Step 4	**topology ipv4** [**multicast**	**unicast**] {*topology-name* [**disable**]	**base**} **Example:** `Device(config-if)# topology ipv4 VOICE`	Enters interface topology configuration mode to configure Multitopology Routing (MTR). **Note** Entering this command with the **disable** keyword disables the topology instance on the interface. This form is used to exclude a topology configuration from an interface.
Step 5	**ip ospf cost** *number*	Applies a cost to the interface in a topology instance.

	Command or Action	Purpose
	Example: Device(config-if-topology)# ip ospf cost 100	• The lowest cost number has the highest preference.
Step 6	**ip ospf topology disable** **Example:** Device(config-if-topology)# ip ospf topology disable	Prevents Open Shortest Path First (OSPF) from advertising the interface as part of the topology without disabling the OSPF process or the topology on the interface.
Step 7	**end** **Example:** Device(config-if-topology)# end	Exits interface topology configuration mode and returns to privileged EXEC mode.
Step 8	**show ip ospf** [*process-id*] **interface** [*type number*] [**brief**] [**multicast**] [**topology** {*topology-name* | **base**}] **Example:** Device# show ip ospf 1 interface topology VOICE	(Optional) Displays OSPF-related interface information. • Displays OSPF and interface information about the specified topology when the **topology** keyword is entered.

Monitoring Interface and Topology IP Traffic Statistics for MTR

Use any of the following commands in any order to monitor interface and topology IP traffic statistics for Multitopology Routing (MTR).

SUMMARY STEPS

1. **enable**
2. **show ip interface** [*type number*] [**topology** {*name* \| **all** \| **base**}] [**stats**]
3. **show ip traffic** [**topology** {*name* \| **all** \| **base**}]
4. **clear ip interface** *type number* [**topology** {*name* \| **all** \| **base**}] [**stats**]
5. **clear ip traffic** [**topology** {*name* \| **all** \| **base**}]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip interface** [*type number*] [**topology** {*name* | **all** | **base**}] [**stats**] **Example:** `Device# show ip interface FastEthernet 1/10 stats`	(Optional) Displays IP traffic statistics for all interfaces or statistics related to the specified interface. • If you specify an interface type and number, information for that specific interface is displayed. If you specify no optional arguments, information for all the interfaces is displayed. • If the **topology** *name* keyword and argument are used, statistics are limited to the IP traffic for that specific topology. • The **base** keyword displays the IPv4 unicast base topology.
Step 3	**show ip traffic** [**topology** {*name* | **all** | **base**}] **Example:** `Device# show ip traffic topology VOICE`	(Optional) Displays global IP traffic statistics (an aggregation of all the topologies when MTR is enabled) or statistics related to a particular topology. • The **base** keyword is reserved for the IPv4 unicast base topology.
Step 4	**clear ip interface** *type number* [**topology** {*name* | **all** | **base**}] [**stats**] **Example:** `Device# clear ip interface FastEthernet 1/10 topology all`	(Optional) Resets interface-level IP traffic statistics. • If the **topology** keyword and a related keyword are not used, only the interface-level aggregate statistics are reset. • If all topologies need to be reset, use the **all** keyword as the topology name.
Step 5	**clear ip traffic** [**topology** {*name* | **all** | **base**}] **Example:** `Device# clear ip traffic topology all`	(Optional) Resets IP traffic statistics. • If no topology name is specified, global statistics are cleared.

Configuration Examples for OSPF Support for MTR

Examples: Activating an MTR Topology by Using OSPF

The following example shows how to configure the VOICE topology in an Open Shortest Path First (OSPF) routing process and set the priority of the VOICE topology to the highest priority:

```
router ospf 1
 address-family ipv4
  topology VOICE tid 10
  priority 127
  end
```

In the following example, the **show ip ospf** command is used with the **topology-info** and **topology** keywords to display OSPF information about the topology named VOICE:

```
Device# show ip ospf 1 topology-info topology VOICE

OSPF Router with ID (10.0.0.1) (Process ID 1)
VOICE Topology (MTID 66)
Topology priority is 64
Redistributing External Routes from,
isis
Number of areas transit capable is 0
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
Maximum wait time between two consecutive SPFs 10000 msecs
Area BACKBONE(0) (Inactive)
SPF algorithm last executed 16:45:18.984 ago
SPF algorithm executed 3 times
Area ranges are
Area 1
SPF algorithm last executed 00:00:21.584 ago
SPF algorithm executed 1 times
Area ranges are
```

Examples: MTR OSPF Topology in Interface Configuration Mode

The following example shows how to disable Open Shortest Path First (OSPF) routing on Ethernet interface 0/0 without removing the interface from the global topology configuration:

```
interface Ethernet 0/0
 topology ipv4 VOICE
  ip ospf cost 100
  ip ospf topology disable
  end
```

In the following example, the **show ip ospf interface** command is used with the **topology** keyword to display information about the topologies configured for OSPF in interface configuration mode:

```
Device# show ip ospf 1 interface topology VOICE

VOICE Topology (MTID 66)
Serial3/0 is up, line protocol is up
   Internet Address 10.0.0.5/30, Area 1
   Process ID 1, Router ID 44.44.44.44, Network Type POINT_TO_POINT
   Topology-MTID    Cost     Disabled     Shutdown       Topology Name
        4            77         no           no              grc
   Transmit Delay is 1 sec, State POINT_TO_POINT
   Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
     oob-resync timeout 40
```

```
   Hello due in 00:00:05
Supports Link-local Signaling (LLS)
Cisco NSF helper support enabled
IETF NSF helper support enabled
Index 1/4, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 10.2.2.2
Suppress hello for 0 neighbor(s)
```

In the following example, the **show ip ospf interface** command is used with the **brief** and **topology** keywords to display information about the topologies configured for OSPF in interface configuration mode:

```
Device# show ip ospf 1 interface brief topology VOICE

VOICE Topology (MTID 66)
Interface   PID   Area   IP Address/Mask   Cost   State   Nbrs F/C
Se3/0       1     1      10.0.0.5/30       1      UP      0/0
Se2/0       1     1      10.0.0.1/30       1      UP      0/0
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Multitopology Routing (MTR) commands	Cisco IOS Multitopology Routing Command Reference
Open Shortest Path First (OSPF) commands	Cisco IOS IP Routing: OSPF Command Reference
OSPF concepts and tasks	*IP Routing: OSPF Configuration Guide*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for OSPF Support for MTR

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for OSPF Support for MTR

Feature Name	Releases	Feature Information
OSPF Support for MTR	12.2(33)SRB	This feature provides Open Shortest Path First (OSPF) support for multiple logical topologies over a single physical network. The following commands were introduced or modified: **address-family ipv4**, **area capability default-exclusion**, **ip ospf cost**, **ip ospf topology disable**, **priority**, **router ospf**, **show ip ospf interface**, **show ip ospf topology-info**, **topology**.