



Multi-Topology Routing

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Multi-Topology Routing (MTR) allows the configuration of service differentiation through class-based forwarding. MTR supports multiple unicast topologies and a separate multicast topology. A topology is a subset of the underlying network (or base topology) characterized by an independent set of Network Layer Reachability Information (NLRI). A topology can overlap with another or share any subset of the underlying network. MTR provides separate forwarding capabilities on a per topology basis. A separate forwarding table is maintained for each topology, allowing you to broadly apply independent forwarding configurations or add a level of granularity to independent forwarding configurations. MTR can be used, for example, to define separate topologies for voice, video, and data traffic classes.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see 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 document.

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

Prerequisites for Multi-Topology Routing

- You should have a clear understanding of the physical topology and traffic classification in your network before deploying MTR.
- MTR should be deployed consistently throughout the network. Cisco Express Forwarding (CEF) or distributed CEF (dCEF) and IP routing must be enabled on all networking devices.
- We recommend that you deconfigure custom route configurations, such as route summarization and default routes before enabling a topology and that you reapply custom route configuration only after the topology is fully enabled. This recommendation is designed to prevent traffic interruption, as some destinations may be obscured during the transition. It is also a best practice when disabling an existing topology. Custom route configuration is most useful when all of the more specific routes are available in the routing table of the topology.

Restrictions for Multi-Topology Routing

- Only the IPv4 (unicast and multicast) address family is supported.
- Multiple unicast topologies cannot be configured within a Virtual Routing and Forwarding (VRF) instance. However, multiple unicast topologies and a separate multicast topology can be configured under the global address space, and a separate multicast topology can be configured within a VRF.
- All topologies share a common address space. MTR is not intended to enable address reuse. Configuring address reuse in separate topologies is not supported.
- IP Differentiated Services or IP Precedence can be independently configured in a network where MTR is also deployed. However, MTR requires exclusive use of some subset of the DiffServ Code Point (DSCP) bits in the IP packet header for specific topology traffic. For this reason, simultaneous configuration must be carefully coordinated. Remarking DSCP bits in the IP packet header is not recommended or supported on routers that contain class-specific topologies.
- Distance Vector Multicast Routing Protocol (DVMRP) CLI and functionality are not provided in Cisco IOS software images that provide MTR support.

Information About Multi-Topology Routing

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MTR Overview

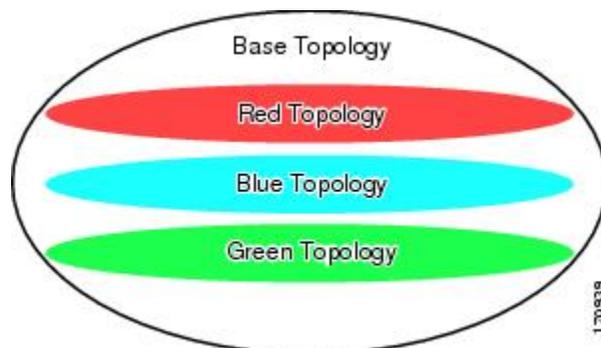
By using MTR, you can configure service differentiation through class-based forwarding. There are two primary components to configuring MTR: independent topology configuration and traffic classification configuration.

A topology is defined as a subset of routers and links in a network for which a separate set of routes is calculated. The entire network itself, for which the usual set of routes is calculated, is known as the base topology. The base topology (or underlying network) is characterized by the NLRI that a router uses to calculate the global routing table to make routing and forwarding decisions. In other words, the base topology is the default routing environment that exists prior to enabling MTR.

Any additional topologies are known as class-specific topologies and are a subset of the base topology. Each class-specific topology carries a class of traffic and is characterized by an independent set of NLRI that is used to maintain a separate Routing Information Base (RIB) and Forwarding Information Base (FIB). This design allows the router to perform independent route calculation and forwarding for each topology.

Within a given router, MTR creates a selection of routes upon which to forward to a given destination. The specific choice of route is based on the class of the packet being forwarded, a class that is an attribute of the packet itself. This design allows packets of different classes to be routed independently from one another. The path that the packet follows is determined by classifiers configured on the routers and interfaces in the network. The figure below shows the base topology, which is a superset of the red, blue, and green topologies.

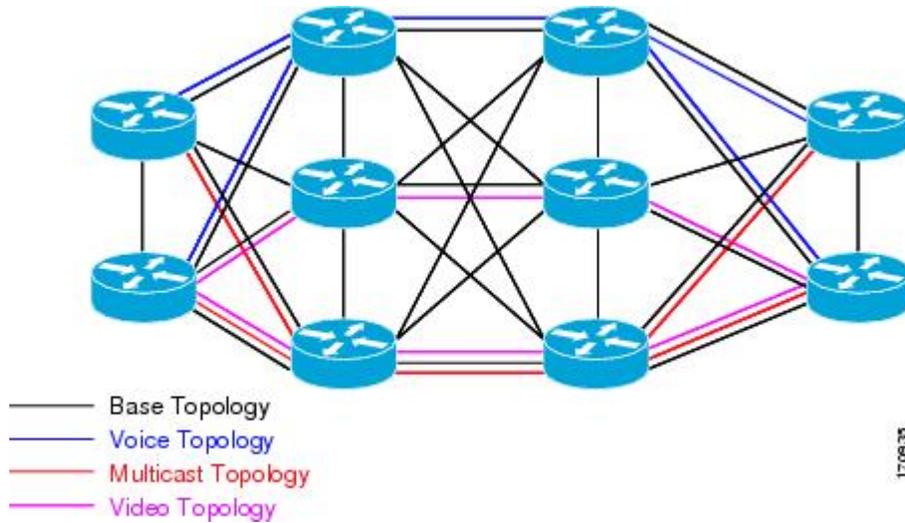
Figure 1: MTR Base Topology



The figure below shows an MTR-enabled network that is configured using the service separation model. The base topology (shown in black) uses NLRI from all reachable devices in the network. The blue, red, and purple paths each represent a different class-specific topology. Each class-specific topology calculates

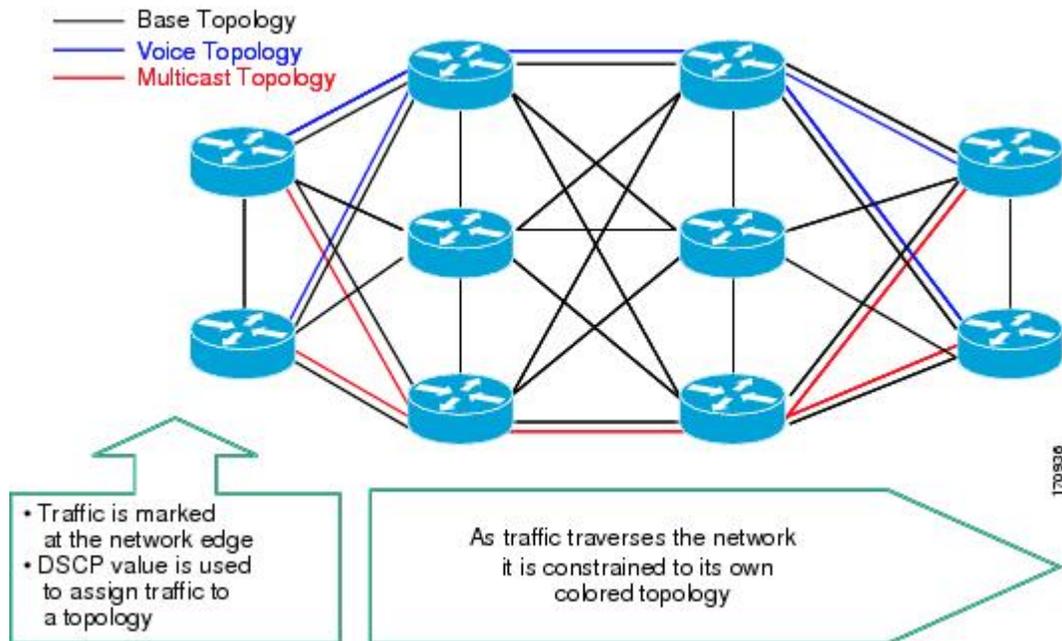
a separate set of paths through the network. Routing and forwarding are independently calculated based on individual sets of NLRI that are carried for each topology.

Figure 2: Defining MTR Topologies



The figure below shows that the traffic is marked at the network edge. As the traffic traverses the network, the marking is used during classification and forwarding to constrain the traffic to its own colored topology.

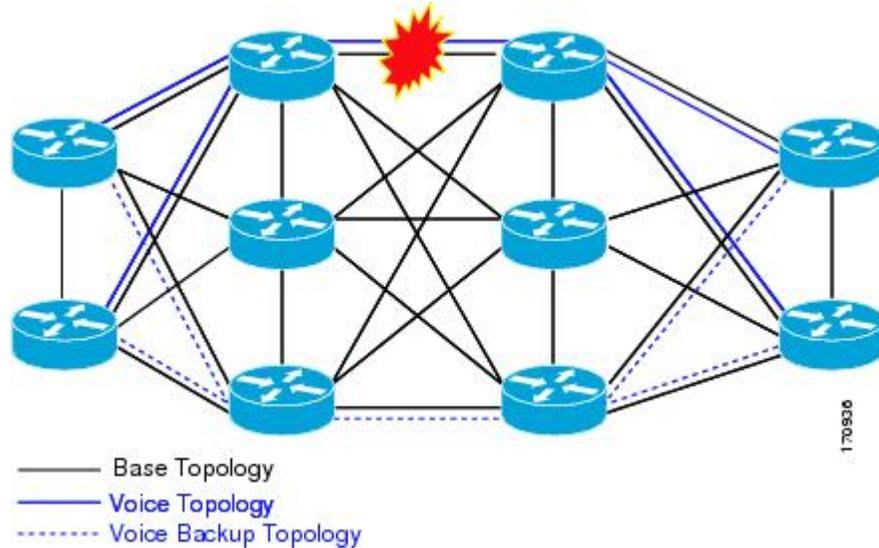
Figure 3: Traffic Follows Class-Specific Forwarding Paths



The same topology can have configured backup paths. In the figure below, the preferential path for the voice topology is represented by the solid blue line. In case this path becomes unavailable, you can

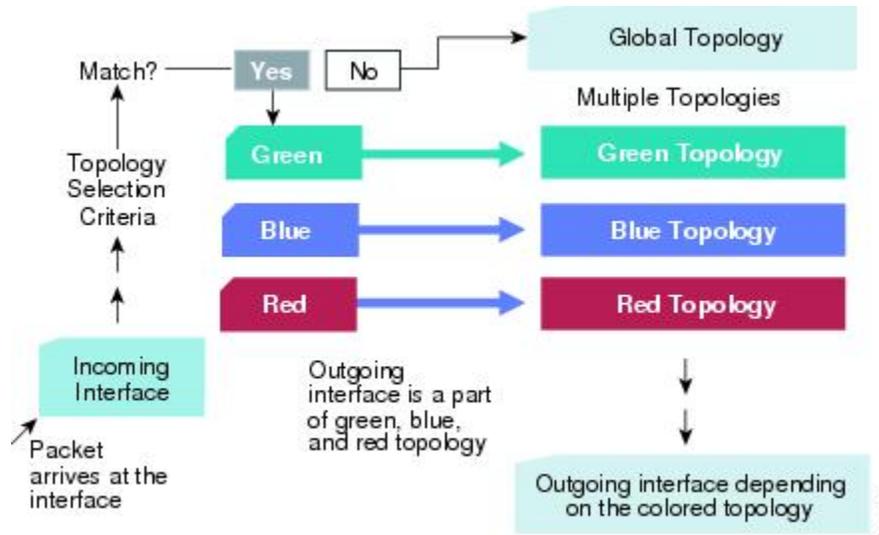
configure MTR to choose the voice backup path represented by the dotted blue line. Both of these paths represent the same topology and none overlap.

Figure 4: MTR Backup Contingencies Within a Topology



The figure below shows the MTR forwarding model at the system level. When a packet arrives at the incoming interface, the marking is examined. If the packet marking matches a topology, the associated topology is consulted, the next hop for that topology is determined, and the packet is forwarded. If there is no forwarding entry within a topology, the packet is dropped. If the packet does not match any classifier, it is forwarded to the base topology. The outgoing interface is a function of the colored route table in which the lookup is done.

Figure 5: MTR Forwarding at the System Level



MTR is implemented in Cisco IOS software on a per address family and subaddress family basis. MTR supports up to 32 unicast topologies (including the base topology) and a separate multicast topology. A

topology can overlap with another or share any subset of the underlying network. You configure each topology with a unique topology ID. You configure the topology ID under the routing protocol, and the ID is used to identify and group NLRI for each topology in updates for a given protocol.

Unicast Topology Support for MTR

You can configure up to 32 unicast topologies on each router. You first define the topology by entering the **global-address-family** command in global configuration mode. The address family and optionally the subaddress family are specified in this step. You then enter the **topology** subcommand in global address family configuration mode. This command places the router in address family topology configuration mode, and the global topology configuration parameters are applied in this mode.

For each new topology that you configure on a router, you increase the total number of routes from the global routing table by the number of routes that are in each new topology [base+topology(*n*)]. If the router carries a large global routing table, and you plan to add a significant number of routes through MTR topology configuration, you can configure the **maximum routes(MTR)** command in address family topology configuration mode to limit the number of routes that the router accepts for a given topology and installs into the corresponding RIB.



Note

Per-interface topology configuration parameters override configurations applied in global address family topology configuration mode and router address family topology configuration mode.

For detailed steps, see the Configuring a Unicast Topology for MTR section.

Multicast Topology Support for MTR

Cisco IOS software supports legacy (pre-MTR) IP multicast behavior by default. MTR support for IP multicast must be explicitly enabled. Legacy IP multicast uses reverse path forwarding on routes in the unicast RIB (base unicast topology) to build multicast distribution trees (MDTs).

MTR introduces a multicast topology that is completely independent from the unicast topology. MTR integration with multicast allows the user to control the path of multicast traffic in the network.

The multicast topology maintains separate routing and forwarding tables. The following list summarizes MTR multicast support that is integrated into Cisco IOS software:

- Conventional longest match support for multicast routes.
- RPF support for Protocol Independent Multicast (PIM).
- Border Gateway Protocol (BGP) MDT subaddress family identifier (SAFI) support for Inter-AS Virtual Private Networks (VPNs) (SAFI number 66).
- Support for static multicast routes is integrated into the **ip route topology** command (modifying the **ip mroute** command).

As in pre-MTR software, you enable multicast support by configuring the **ip multicast-routing** command in global configuration mode. You enable MTR support for multicast by configuring the **ip multicast rpf mult topology** command. The **global-address-family** command is entered with the IPv4 address family and multicast subaddress family. You then enter the **topology** command with the **base** keyword, and global topology configuration parameters are applied in this mode.

For detailed steps, see the Configuring a Multicast Topology for MTR section.

MTR Traffic Classification

MTR cannot be enabled on a router until traffic classification is configured, even if only one class-specific topology is configured. Traffic classification is used to configure topology specific forwarding behaviors when multiple topologies are configured on the same router. Traffic classification must be applied consistently throughout the network. Class-specific packets are associated with the corresponding topology table forwarding entries.

Traffic classification is configured by using the Modular QoS CLI (MQC). MTR traffic classification is similar to QoS traffic classification. However, there is an important distinction. MTR traffic classification is defined globally for each topology, rather than at the interface level as in QoS.

A subset of DSCP bits is used to encode classification values in the IP packet header. You configure a class map to define the traffic class by entering the **class-map** command in global configuration mode. Only the **match-any** keyword is supported for MTR. You associate the traffic class with a policy by configuring the **policy-map type class-routing ipv4 unicast** command in global configuration mode. You activate the policy for the topology by configuring the **service-policy type class-routing** command in global address family configuration mode. When configured, the service policy is associated with all interfaces on the router.

Some of the same goals can be achieved through QoS configuration, to which MTR provides a more powerful and flexible alternative. You can configure MTR traffic classification and IP Differentiated Services or IP Precedence-based traffic classification in the same network. However, MTR requires exclusive use of some subset of the DSCP bits in the IP packet header for specific topology traffic. In a network where MTR and QoS traffic classification are configured, simultaneous configuration must be carefully coordinated.

For detailed steps, see the Configuring MTR Traffic Classification section.

Routing Protocol Support for MTR

You must enable IP routing on the router for MTR to operate. MTR supports static and dynamic routing in Cisco IOS software. You can enable dynamic routing per-topology to support inter-domain and intra-domain routing. Route calculation and forwarding are independent for each topology. MTR support is integrated into Cisco IOS 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 entering 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 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 non-base topologies. For routing protocol support for EIGRP, IS-IS, and OSPF, you must explicitly configure a non-base 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 non-base topology to be configured on all interfaces of the router that are part of the default address space or the VRF in which the topology is configured.

BGP Routing Protocol Support for MTR

- [BGP Network Scope, page 8](#)
- [MTR CLI Hierarchy Under BGP, page 8](#)
- [BGP Sessions for Class-Specific Topologies, page 9](#)
- [Topology Translation Using BGP, page 9](#)
- [Topology Import Using BGP, page 9](#)

BGP Network Scope

To implement MTR for BGP, the scope hierarchy is required, but the scope hierarchy is not limited to MTR use. The scope hierarchy introduces some new configuration modes such as router scope configuration mode. You enter router scope configuration mode by configuring the **scope** command in router configuration mode. When this command is entered, a collection of routing tables is created.

You configure BGP commands under the scope hierarchy for a single network (globally), or on a per-VRF basis, and are referred to as scoped commands. The scope hierarchy can contain one or more address families.

MTR CLI Hierarchy Under BGP

The BGP CLI provides backward compatibility for pre-MTR BGP configuration and provides a hierarchical implementation of MTR. Router configuration mode is backward compatible with the pre-address family and pre-MTR configuration CLI. Global commands that affect all networks are configured in this configuration mode. For address-family and topology configuration, you configure general session commands and peer templates to be used in the address-family or in the topology configuration mode.

After configuring any global commands, you define the scope either globally or for a specific VRF. You enter address family configuration mode by configuring the **address-family** command in router scope configuration mode or in router configuration mode. Unicast is the default address family if no subaddress family (SAFI) is specified. MTR supports only the IPv4 address family with a SAFI of unicast or multicast.

Entering address family configuration mode from router configuration mode configures BGP to use pre-MTR-based CLI. This configuration mode is backward compatible with pre-existing address family configurations. Entering address family configuration mode from router scope configuration mode configures the router to use the hierarchical CLI that supports MTR. Address family configuration parameters that are not specific to a topology are entered in this address family configuration mode.

You enter BGP topology configuration mode by configuring the **topology(BGP)** command in address family configuration mode. You can configure up to 32 topologies (including the base topology) on a router. You configure the topology ID by entering the **bgp tid** command. All address family and subaddress family configuration parameters for the topology are configured here.

**Note**

Configuring a scope for a BGP routing process removes CLI support for pre-MTR-based configuration.

The following example shows the hierarchy levels that are used when configuring BGP for MTR implementation:

```
router bgp <autonomous-system-number>
  ! Global commands

  scope {global | vrf <vrf-name>}
  ! Scoped commands

  address-family {<afi>} [<safi>]
  ! Address family specific commands

  topology {<topology-name> | base}
  ! topology specific commands
```

For detailed steps, see the Activating an MTR Topology by Using BGP section.

BGP Sessions for Class-Specific Topologies

MTR is configured under BGP on a per-session basis. The base unicast and multicast topologies are carried in the global (default) session. A separate session is created for each class-specific topology that is configured under a BGP routing process. Each session is identified by its topology ID. BGP performs a best-path calculation individually for each class-specific topology. A separate RIB and FIB are maintained for each session.

Topology Translation Using BGP

Depending on the design and policy requirements for your network, you might need to install routes from a class-specific topology on one router in a class-specific topology on a neighboring router. Topology translation functionality using BGP provides support for this operation. Topology translation is BGP neighbor-session based. You configure the **neighbor translate-topology** command by using the IP address and topology ID from the neighbor.

The topology ID identifies the class-specific topology of the neighbor. The routes in the class-specific topology of the neighbor are installed in the local class-specific RIB. BGP performs a best-path calculation on all installed routes and installs these routes into the local class-specific RIB. If a duplicate route is translated, BGP selects and installs only one instance of the route per standard BGP best-path calculation behavior.

Topology Import Using BGP

Topology import functionality using BGP is similar to topology translation. The difference is that routes are moved between class-specific topologies on the same router by using BGP. You configure this function by entering the **import topology** command and specify the name of the class-specific topology or base topology. Best-path calculations are run on the imported routes before they are installed into the topology RIB. This command also includes a **route-map** keyword to allow you to filter routes that are moved between class-specific topologies.

For detailed steps, see the Importing Routes from an MTR Topology by Using BGP section.

Interface Configuration Support for MTR

The configuration of an 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 optionally specified. If no subaddress family is specified, the unicast subaddress family is used by default.

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

The interface configuration support for MTR has these characteristics:

- Per-interface routing configuration: 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. Interface configuration mode IGP command are documented in the configuration section for each routing protocol.
- 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.
- 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.
- IS-IS interface topology configuration: Interface mode IS-IS configurations for a class-specific topology are applied in interface topology configuration mode. By this mode, you can configure an interface cost or disable IS-IS routing without removing the interface from the global topology configuration.

For detailed steps, see the Configuring an MTR Topology in Interface Configuration Mode section.

Network Management Support for MTR

Context-based Simple Network Management Protocol (SNMP) support has been integrated into Cisco IOS software. SNMP support for MTR leverages context-based SNMP to extend support for existing MIBs from representing the management information for just the base topology to representing the same information for multiple topologies.

You can configure the SNMP agent software component on the router to pass a context string to existing MIB access functions. Network management applications can provide these context strings in SNMP transactions to direct those transactions to a specific virtual private network (VPN) routing and forwarding (VRF) instance, a specific topology, and/or routing protocol instance. The SNMP infrastructure on the receiving router verifies that a context string is defined for the router, and that the accompanying internal identifier is defined for that context string, before passing the context string and the internal identifier to the MIB access function.

For detailed steps, see the Configuring SNMP Support for MTR section.

Standard network management utilities, such as ping and traceroute, have been enhanced to support MTR. You can configure a standard or extended ping using the topology name in place of a hostname or IP

address. Traceroute has been similarly enhanced. For detailed steps, see the Testing Network Connectivity for MTR section.

ISSU--MTR

All protocols and applications that support MTR and that also support In Service Software Upgrade (ISSU) have extended their ISSU support to include the MTR functionality. See the Cisco IOS In Service Software Upgrade Process module in the *Cisco IOS High Availability Configuration Guide* for information on ISSU-capable protocols and applications.

ISSU allows a high-availability (HA) system to run in Stateful Switchover (SSO) mode even when different versions of Cisco IOS software are running on the active and standby Route Processors (RPs). This feature allows the system to switch over to a secondary RP that is running upgraded (or downgraded) software and to continue forwarding packets without session loss and with minimal or no packet loss.

This feature is enabled by default.

MTR Deployment Models

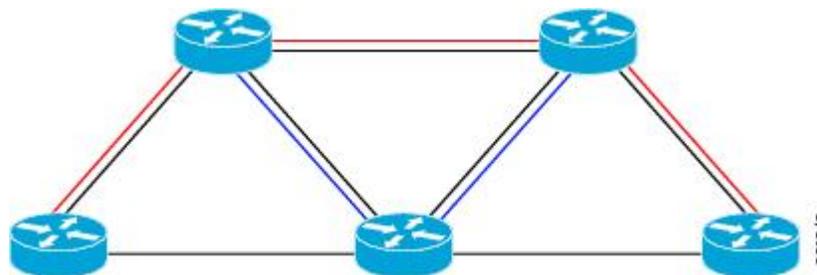
The base topology is the superset of all topologies in the network. It is defined by NLRI for all reachable routers regardless of the deployment model that is used. MTR can be deployed using the service separation MTR model shown in figure "Service-Separation MTR Model," or it can be deployed using the overlapping MTR model shown in figure "Overlapping MTR Model." Each of these models represent a different approach to deploying MTR. However, these models are not mutually exclusive. Any level of variation of a combined model can be deployed.

- [Service Separation MTR Model, page 11](#)
- [Overlapping MTR Model, page 11](#)

Service Separation MTR Model

The figure below shows the service separation model where no colored topologies (except for the base) overlap with each other. In the service separation model, each class of traffic is constrained to its own exclusive topology. This model restricts the given class of traffic to a subset of the network. This model is less configuration intensive because no topology-specific metrics need to be configured.

Figure 6: Service-Separation MTR Model

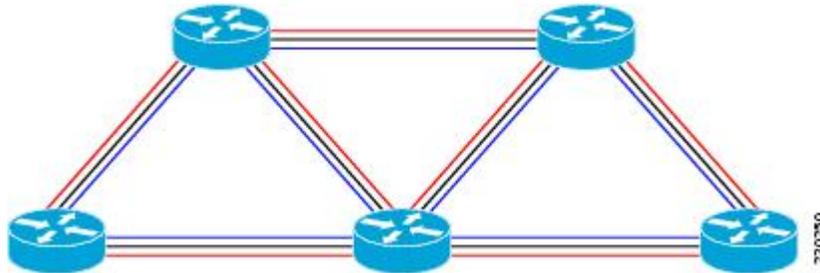


Overlapping MTR Model

In the overlapping MTR model, all topologies are configured to run over all routers in the network. This model provides the highest level of redundancy. All classes of traffic can use all links. Per-topology metrics

are then configured to bias different classes of traffic to use different parts of the network. The redundancy that this model provides, however, makes it more configuration intensive. The figure below shows the red and gray topologies. All topologies are configured to run over all network routers. In this model, per-topology metrics are configured to bias the preferred routes for each topology.

Figure 7: Overlapping MTR Model



MTR Deployment Configuration

MTR supports both full and incremental deployment configurations. To support these options, MTR provides two different, configurable forwarding rules: strict forwarding mode for full deployment and incremental forwarding mode for an incremental deployment.

- [Full Deployment, page 12](#)
- [Incremental Deployment, page 12](#)

Full Deployment

Strict forwarding mode is the default forwarding mode in MTR. In this mode, the router looks for a forwarding route only in the class-specific FIB. If no forwarding route is found, the packet is dropped. In this mode, the router performs a longest match look up for the topology FIB entry. This mode is designed for full deployment, where MTR is enabled on every router in the network or every router in the topology. Strict forwarding mode should be enabled after an incremental deployment transition is completed or when all routers in the network or topology are MTR enabled. Strict forwarding mode can be enabled after incremental forwarding mode by entering the **no forward-base** command in address family topology configuration mode.

Incremental Deployment

Incremental forwarding mode is designed to support transitional or incremental deployment of MTR, where routers in the network are not MTR enabled. In this mode, the router looks for a forwarding entry first in the class-specific FIB. If an entry is not found, the router looks for the longest match in the base topology FIB. If an entry is found in the base topology FIB, the packet is forwarded on the base topology. If a forwarding entry is not found in the base topology FIB, the packet is dropped.

This mode is designed to preserve connectivity during an incremental deployment of MTR and is recommended for use only during migration (the transition from a non-MTR to MTR enabled network). Class-specific traffic for a given destination is forwarded over contiguous segments of the class-specific topology containing that destination; otherwise, it is forwarded over the base topology.

This forwarding mode can be enabled to support mixed networks where some routers are not configured to run MTR. Incremental forwarding mode is enabled by entering the **forward-base** command in address family topology configuration mode.

Guidelines for Enabling and Disabling MTR

The section provides guidelines and procedures for enabling or disabling MTR in a production network. These guidelines assume that all participating networking devices are running a software image that supports MTR. They are designed to prevent major traffic interruptions due to misconfiguration and to minimize temporary transitional effects that can occur when introducing or removing a topology from a network. The guidelines described below must be implemented in the order that they are described.

First, create a class-specific topology on all networking devices and enable incremental forwarding mode by entering the **forward-base** command in the address family topology configuration. Configure incremental forwarding whenever a topology is introduced or removed from the network. The topology is defined as a global container at this stage. No routing or forwarding can occur within the topology. Routing protocol support should not be configured.

Second, configure classification rules for the class-specific topology. You must consistently apply classification on all routers in the topology; each router has identical classifier configuration. You activate the topology when you attach a valid classification configuration to the global topology configuration. You can use ping and trace route to verify reachability for interfaces and networking devices that are in the same topology and configured with identical classification.

Third, configure routing protocol support and/or static routing. Configure the routers in the topology one at a time. This configuration includes interface, router process, and routing protocol-specific metrics and filters.

Enable routing in the topology by using a physical pattern in a contiguous manner relative to a single starting point. For example, configure all interfaces on a single router, and then all interfaces on each adjacent router. Follow this pattern until the task is complete. The starting point can be on the edge or core of the network. This recommendation is designed to increase the likelihood that class-specific traffic is forwarded on the same paths in the incremental topology as it is on the full topology when MTR is completely deployed.

If your network design requires strict forwarding mode, you should disable incremental forwarding only after you configure routing on all routers in a given topology. At this stage, MTR is fully operational. Class-specific traffic is forwarded only over devices within the topology. Traffic that is not classified or destined for the topology is dropped.

When disabling a topology, reenable incremental forwarding mode. Remove custom route configuration, such as route summarization and default routes before disabling a topology, and reapply custom route configuration only after the topology is reenabled. This recommendation is designed to prevent traffic interruption, as some destinations might be obscured during the transition. Custom route configuration is most useful when all of the more specific routes are available in the routing table of the topology.

**Note**

These recommendations apply only when a given classifier is enabled or disabled for a given topology. All other MTR configuration, including interface and routing protocol specific configuration (other than the topology ID) can be modified dynamically as necessary.

How to Configure Multi-Topology Routing

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- [Configuring MTR Traffic Classification, page 18](#)

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Configuring a Unicast Topology for MTR

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **global-address-family ipv4 [multicast | unicast]**
4. **topology {base | topology-name}**
5. **all-interfaces**
6. **forward-base**
7. **maximum routes number [threshold [reinstall threshold] | warning-only]**
8. **shutdown**
9. **end**
10. **show topology [cache [topology-id] | ha | [[detail | interface | lock | router] [all | ipv4 | ipv6 | vrf vpn-instance]]]**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	global-address-family ipv4 [multicast unicast]	Enters global address family topology configuration mode to configure the global topology.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router(config)# global-address-family ipv4</pre>	<ul style="list-style-type: none"> The address family for the class-specific topology is specified in this step. The subaddress family can be optionally specified. Unicast is the default if no subaddress family is entered.
Step 4	<p>topology {base <i>topology-name</i>}</p> <p>Example:</p> <pre>Router(config-af)# topology VOICE</pre>	<p>Configures the global topology instance and enters address family topology configuration mode.</p> <ul style="list-style-type: none"> The base keyword is used to configure the base topology or a multicast topology. The <i>topology-name</i> argument is entered to label a class-specific topology. Topology names are case-sensitive. For example, VOICE and voice identify two different topologies. MTR supports 32 unicast topologies including the base topology.
Step 5	<p>all-interfaces</p> <p>Example:</p> <pre>Router(config-af-topology)# all-interfaces</pre>	<p>(Optional) Configures the topology instance to use all interfaces on a router.</p> <ul style="list-style-type: none"> By default, no interfaces are used. <p>Note The configuration of this command does not override the topology configuration applied in interface configuration mode.</p>
Step 6	<p>forward-base</p> <p>Example:</p> <pre>Router(config-af-topology)# forward-base</pre>	<p>(Optional) Configures the forwarding mode under a topology instance.</p> <ul style="list-style-type: none"> Strict mode (default) configures the router to look for forwarding entries only in the topology-specific FIB. If an entry is not found, the packet is dropped. Incremental mode (enable form) configures the router to look first in the class-specific topology FIB. If a forwarding route is not found, then the router looks in the base topology FIB.
Step 7	<p>maximum routes <i>number</i> [threshold reinstall <i>threshold</i>] warning-only</p> <p>Example:</p> <pre>Router(config-af-topology)# maximum routes 1000 warning-only</pre>	<p>(Optional) Configures the maximum number of routes that a topology instance accepts and installs into the RIB.</p> <ul style="list-style-type: none"> Use the warning-only keyword to generate only a warning, to set an upper limit, and to set a lower limit (low water mark) for reinstalling routes after the maximum limit has been exceeded.
Step 8	<p>shutdown</p> <p>Example:</p> <pre>Router(config-af-topology)# shutdown</pre>	<p>(Optional) Temporarily disables a topology instance without removing the topology configuration (while other topology parameters are configured and other routers are configured with MTR).</p>
Step 9	<p>end</p> <p>Example:</p> <pre>Router(config-af-topology)# end</pre>	<p>(Optional) Exits routing topology configuration mode and enters privileged EXEC mode.</p>

	Command or Action	Purpose
Step 10	show topology [<i>cache</i> [<i>topology-id</i>] ha [[<i>detail</i> interface lock router] [all ipv4 ipv6 vrf <i>vpn-instance</i>]]] Example: Router# show topology	(Optional) Displays information about class-specific and base topologies.

- [What to Do Next, page 16](#)

What to Do Next

Repeat this task for each unicast topology instance that you need to create.

Configuring a Multicast Topology for MTR



Note

- Only a single multicast topology can be configured, and only the **base** keyword can be entered when the multicast topology is created in Step 6.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing** [*vrf name*]
4. **ip multicast rpf mult topology**
5. **global-address-family ipv4** [**multicast** | **unicast**]
6. **topology** {**base** | *topology-name*}
7. **route-replicate from** {**multicast** | **unicast**} [**topology** {**base** | *name*}] *protocol* [**route-map** *name*] **vrf** *name*]
8. **use-topology unicast** {**base** | *topology-name*}
9. **shutdown**
10. **end**
11. **show topology** [*cache* [*topology-ID*] | **ha** | [[**detail** | **interface** | **lock** | **router**] [**all** | **ipv4** | **ipv6** | **vrf** *vpn-instance*]]]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router> enable</pre>	
Step 2	<p>configure terminal</p> <p>Example:</p> <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3	<p>ip multicast-routing [vrf name]</p> <p>Example:</p> <pre>Router(config)# ip multicast-routing</pre>	Enables IP multicast routing.
Step 4	<p>ip multicast rpf mult topology</p> <p>Example:</p> <pre>Router(config)# ip multicast rpf multitopology</pre>	Enables MTR support for IP multicast routing.
Step 5	<p>global-address-family ipv4 [multicast unicast]</p> <p>Example:</p> <pre>Router(config)# global-address-family ipv4 multicast</pre>	<p>Enters global address family configuration mode to configure the global topology.</p> <ul style="list-style-type: none"> The address family for the class-specific topology is specified in this step. The subaddress family can be specified. Unicast is the default if no subaddress family is entered.
Step 6	<p>topology {base topology-name}</p> <p>Example:</p> <pre>Router(config-af)# topology base</pre>	<p>Configures the global topology instance and enters address family topology configuration mode.</p> <ul style="list-style-type: none"> Only the base keyword can be accepted for a multicast topology.
Step 7	<p>route-replicate from {multicast unicast} [topology {base name}] protocol [route-map name] vrf name]</p> <p>Example:</p> <pre>Router(config-af-topology)# route- replicate from unicast topology VOICE ospf 100 route-map map1</pre>	<p>(Optional) Replicates (copies) routes from another multicast topology RIB.</p> <ul style="list-style-type: none"> The <i>protocol</i> argument is configured to specify the protocol which is the source of the route. Routes can be replicated from the unicast base topology or a class-specific topology. <p>Note However, route replication cannot be configured from a class-specific topology that is configured to forward the base topology (incremental forwarding).</p> <ul style="list-style-type: none"> Replicated routes can be filtered through a route map before they are installed into the multicast RIB.
Step 8	<p>use-topology unicast {base topology-name}</p>	(Optional) Configures a multicast topology to perform RPF computations using a unicast topology RIB.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router(config-af-topology)# use- topology unicast VIDEO</pre>	<ul style="list-style-type: none"> The base or a class-specific unicast topology can be configured. When this command is configured, the multicast topology uses routes in the specified unicast topology table to build multicast distribution trees. <p>Note This multicast RIB is not used when this command is enabled, even if the multicast RIB is populated and supported by a routing protocol.</p>
Step 9	<p>shutdown</p> <p>Example:</p> <pre>Router(config-af-topology)# shutdown</pre>	(Optional) Temporarily disables a topology instance without removing the topology configuration (while other topology parameters are configured and other routers are configured with MTR).
Step 10	<p>end</p> <p>Example:</p> <pre>Router(config-af-topology)# end</pre>	(Optional) Exits address family topology configuration mode and enters privileged EXEC mode.
Step 11	<p>show topology [cache [topology-ID] ha [[detail interface lock router] [all ipv4 ipv6 vrf vpn-instance]]]</p> <p>Example:</p> <pre>Router# show topology detail</pre>	(Optional) Displays information about class-specific and base topologies.

- [What to Do Next, page 18](#)

What to Do Next

The topology is not activated until classification is configured. Proceed to the Configuring MTR Traffic Classification section to configure classification for a class-specific topology.

Configuring MTR Traffic Classification



Note

Following the correct order of the commands in this task is very important. Ensure that all configuration that affects traffic classification is complete before entering the **service-policy type class-routing** command.

- Be familiar with the concepts documented in the MTR Traffic Classification section.
- Define a topology globally (rather than at the interface level as in QoS) before configuring traffic classification
- Ensure that all routers throughout the network have the same definition of classifiers and the same sequencing of classifiers.
- Carefully coordinate simultaneous configuration In a network where MTR and QoS traffic classification are configured.



Note

- MTR classification values must be unique for each topology. An error message is generated if you attempt to configure overlapping values.
- A topology cannot be placed in the shutdown state if it is referenced by any active policy map.
- A subset of DSCP bits is used to encode classification values in the IP packet header. Certain DSCP values are reserved. These DSCP values are commonly used by routing software components for purposes unrelated to MTR (for example, OSPF, BFD, and/or SNMP). Using these values for MTR classification is likely to interfere with correct operation of the router and is strongly discouraged. These values include:
 - DSCP 48 (cs6)
 - DSCP 16 (cs2)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map match-any *class-map-name***
4. **match [ip] dscp *dscp-value*[*dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value*]**
5. **exit**
6. **policy-map type class-routing ipv4 unicast *policy-map-name***
7. **class {*class-name* | class-default }**
8. **select-topology *topology-name***
9. **exit**
10. **exit**
11. **global-address-family ipv4 [multicast | unicast]**
12. **service-policy type class-routing *policy-map-name***
13. **end**
14. **show topology detail**
15. **show policy-map type class-routing ipv4 unicast [interface [*interface-type interface-number*]]**
16. **show mtm table**

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>enable</p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal	Enters global configuration mode.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router# configure terminal</pre>	
Step 3	<p>class-map match-any <i>class-map-name</i></p> <p>Example:</p> <pre>Router(config)# class-map match-any VOICE-CLASS</pre>	<p>Creates a class map to be used for matching packets to a specified class and enters class-map configuration mode.</p> <ul style="list-style-type: none"> The MTR traffic class is defined using this command. <p>NoteThe match-any keyword must be entered when configuring classification for MTR.</p>
Step 4	<p>match [ip] dscp <i>dscp-value</i>[<i>dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value</i>]</p> <p>Example:</p> <pre>Router(config-cmap)# match ip dscp 9</pre>	<p>Identifies a DSCP value as a match criteria.</p> <ul style="list-style-type: none"> Use the <i>dscp-value</i> argument to define a specific metric value. Do not use the DSCP values 48 and 16. See the Restrictions section for more information.
Step 5	<p>exit</p> <p>Example:</p> <pre>Router(config-cmap)# exit</pre>	<p>Exits class-map configuration mode.</p>
Step 6	<p>policy-map type class-routing ipv4 unicast <i>policy-map-name</i></p> <p>Example:</p> <pre>Router(config)# policy-map type class-routing ipv4 unicast VOICE-CLASS-POLICY</pre>	<p>Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy and enters policy-map configuration mode.</p> <ul style="list-style-type: none"> If you do not specify the type keyword option, the command defaults to the QoS policy.
Step 7	<p>class {<i>class-name</i> class-default}</p> <p>Example:</p> <pre>Router(config-pmap)# class VOICE-CLASS</pre>	<p>Specifies the name of the class whose policy you want to create or change or specifies the default class and enters policy-map class configuration mode.</p> <ul style="list-style-type: none"> The class map is referenced. For a class map to be referenced in a class-routing policy map, it must first be defined by the class-map command as shown in Step 3.
Step 8	<p>select-topology <i>topology-name</i></p> <p>Example:</p> <pre>Router(config-pmap-c)# select-topology VOICE</pre>	<p>Attaches the policy map to the topology.</p>
Step 9	<p>exit</p> <p>Example:</p> <pre>Router(config-pmap-c)# exit</pre>	<p>Exits policy-map class configuration mode.</p>

	Command or Action	Purpose
Step 10	exit Example: Router(config-pmap)# exit	Exits policy-map configuration mode.
Step 11	global-address-family ipv4 [multicast unicast] Example: Router(config)# global-address-family ipv4	Enters global address family configuration mode to configure MTR.
Step 12	service-policy type class-routing <i>policy-map-name</i> Example: Router(config-af)# service-policy type class-routing VOICE-CLASS-POLICY	Attaches the service policy to the policy map for MTR traffic classification and activates MTR. <ul style="list-style-type: none"> The <i>policy-map-name</i> argument must match that configured in step 6. <p>NoteAfter this command is entered, traffic classification is enabled. Ensure that all configuration that affects traffic classification is complete before entering this important command.</p>
Step 13	end Example: Router(config-af)# end	Exits global address family configuration mode and returns to privileged EXEC mode.
Step 14	show topology detail Example: Router# show topology detail	(Optional) Displays detailed information about class-specific and base topologies.
Step 15	show policy-map type class-routing ipv4 unicast [interface [<i>interface-type interface-number</i>]] Example: Router# show policy-map type class-routing ipv4 unicast	(Optional) Displays the class-routing policy map configuration. <ul style="list-style-type: none"> If you specify the interface keyword without the argument, statistics on all interfaces under the global space are displayed.
Step 16	show mtm table Example: Router# show mtm table	(Optional) Displays information about the DSCP values assigned to each topology.

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What to Do Next

The next four tasks show how to enable MTR support under a routing protocol. Proceed to the Activating an MTR Topology by Using OSPF section to enable routing protocol support.

Activating an MTR Topology by Using OSPF



Note

Only MTR commands are shown in this task.

- Be familiar with the concepts documented in the Routing Protocol Support for MTR section.
- Configure and activate a global topology configuration.
- Check your OSPF router configuration and enter the topology-aware router configuration commands in router address family configuration mode.
- Several OSPF router configuration commands need to be topology-aware. Before you configure OSPF MTR, you need to enter these commands in router address family configuration mode if they are used in your original OSPF router configuration.
 - **area** *area-id* **default-cost** *cost*
 - **area** *area-id* **filter-list prefix** {*prefix-list-name* **in** | **out**}
 - **area** *area-id* **nssa** [**default-information-originate** [**metric** *metric-number*] [**metric-type**]] | [**no-redistribution**] | [**no-summary**] [**metric**] [*metric-type*] [**translate type7 suppress-fa**]
 - **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 (IP)**
 - **distribute-list out (IP)**
 - **max-metric router-lsa** [**on-startup** {*seconds* | **wait-for-bgp**}]
 - **maximum-paths** *maximum maximum-paths*{ [*number-of-paths*] [**import** *number-of-paths*] | [**import** *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**

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: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	router ospf <i>process-id</i> [vrf <i>vrf-name</i>] Example: Router(config)# router ospf 1	Enables an OSPF routing process and enters router configuration mode.
Step 4	address-family ipv4 [multicast unicast] Example: Router(config-router)# address-family ipv4	Enter router address family configuration mode to configure an OSPF address family session. <ul style="list-style-type: none"> • Currently, only the base topology can be configured under the multicast subaddress family.
Step 5	topology { base <i>topology-name</i> tid <i>number</i> } Example: Router(config-router-af)# topology VOICE tid 10	Configures OSPF support for the topology and assigns a TID number for each topology. Enters router address family topology configuration mode. <ul style="list-style-type: none"> • Use the tid keyword and <i>number</i> 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. <p>NoteThe base keyword is accepted only for IPv4 multicast. The tid keyword is accepted only for IPv4 or IPv6 unicast.</p>
Step 6	end	Exits router address family topology configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
	Example: Router(config-router-af-topology)# end	
Step 7	show ip ospf [<i>process-id</i>] topology-info [multicast] [topology { <i>topology-name</i> base }]	(Optional) Displays OSPF information about the specified topology.
	Example: Router# show ip ospf topology-info topology VOICE	

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What to Do Next

If an EIGRP topology configuration is required, proceed to the next task. If an IS-IS topology configuration is required proceed to the Activating an MTR Topology by Using IS-IS section.

Activating an MTR Topology by Using EIGRP



Note

Only MTR commands are shown in this task.

- Be familiar with the concepts in the Routing Protocol Support for MTR section.
- Configure and activate a global topology configuration.



Note

- Graceful restart in EIGRP works only for base topologies. All other service topologies reset with new adjacencies.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router eigrp** *name*
4. **address-family ipv4** [**unicast** | **multicast** | **vrf** *vrf-name*] **autonomous-system** *as-number*
5. **topology** {**base** | *topology-name* **tid** *number*}
6. **end**
7. **show ip protocols topology** *name* [**summary**]
8. **show ip eigrp topology** *name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	router eigrp name Example: Router(config)# router eigrp MTR	Configures an EIGRP process for MTR, and enters router configuration mode. <ul style="list-style-type: none"> You can use the command without configuring MTR, but it defaults to the base topology.
Step 4	address-family ipv4 [unicast multicast vrf vrf-name] autonomous-system as-number Example: Router(config-router)# address-family ipv4 autonomous-system 1	Enters router address family configuration mode to configure EIGRP for MTR.
Step 5	topology {base topology-name tid number} Example: Router(config-router-af)# topology VIDEO tid 100	Configures an EIGRP process to route IP traffic under the specified topology instance and enters router address family topology configuration mode. <ul style="list-style-type: none"> Each topology must be configured with a unique topology ID. The topology ID must be entered each time this command is entered.
Step 6	end Example: Router(config-router-af-topology)# end	Exits router address family configuration mode and returns to privileged EXEC mode.
Step 7	show ip protocols topology name [summary] Example: Router# show ip protocols topology VIDEO	Displays the status of routing protocols configured in a topology. Tip This command can be entered to display the status, under a topology, of any configured routing protocol.
Step 8	show ip eigrp topology name Example: Router# show ip eigrp topology VIDEO	Displays the routing table of an EIGRP process configured under a topology.

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What to Do Next

If an IS-IS topology configuration is required, proceed to the next task. If a BGP topology configuration is required, proceed to the Activating an MTR Topology by Using BGP section.

Activating an MTR Topology by Using IS-IS



Note

Only MTR commands are shown in this task.

- Be familiar with the concepts in the Routing Protocol Support for MTR section.
- Configure and activate a global topology configuration.
- Activate an MTR topology on an IS-IS router.
- Configure the MTR topology to globally configure all interfaces using the **all-interfaces** address family topology configuration command, or configure the IS-IS topology in interface configuration mode to configure only IS-IS interfaces. The order in which you perform the two tasks does not matter.



Note

- Only the IPv4 address family (multicast and unicast) and IPv6 address family unicast are supported. For information about configuring Multitopology IS-IS for IPv6, see the Implementing IS-IS for IPv6 module in the *Cisco IOS IPv6 Configuration Guide*.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** [*area-tag*]
4. **net** *network-entity-title*
5. **metric-style wide** [**transition**] [**level-1** | **level-2** | **level-1-2**]
6. **address-family ipv4** [**multicast** | **unicast**]
7. **topology** *topology-name* **tid** *number*
8. **end**
9. **show isis neighbors detail**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	router isis [<i>area-tag</i>] Example: Router(config)# router isis	Enables the IS-IS routing protocol and optionally specifies an IS-IS process. Enters router configuration mode.
Step 4	net <i>network-entity-title</i> Example: Router(config-router)# net 31.3131.3131.3131.00	Configures an IS-IS network entity title (NET) for a Connectionless Network Service (CLNS) routing process.
Step 5	metric-style wide [transition] [level-1 level-2 level-1-2] Example: Router(config-router)# metric-style wide	Globally changes the metric value for all IS-IS interfaces. Note Wide style metrics are required for prefix tagging.
Step 6	address-family ipv4 [multicast unicast] Example: Router(config-router)# address-family ipv4	Enters router address family configuration mode under IS-IS router configuration mode.
Step 7	topology <i>topology-name</i> tid <i>number</i> Example: Router(config-router-af)# topology DATA tid 100	Configures IS-IS support for the topology and assigns a TID number for each topology. <ul style="list-style-type: none"> IS-IS support for the DATA topology is configured.
Step 8	end Example: Router(config-router-topology)# end	Exits router address family configuration mode and returns to privileged EXEC mode.
Step 9	show isis neighbors detail Example: Router# show isis neighbors detail	(Optional) Displays information about IS-IS neighbors, including MTR information for the TID values for the router and its IS-IS neighbors.

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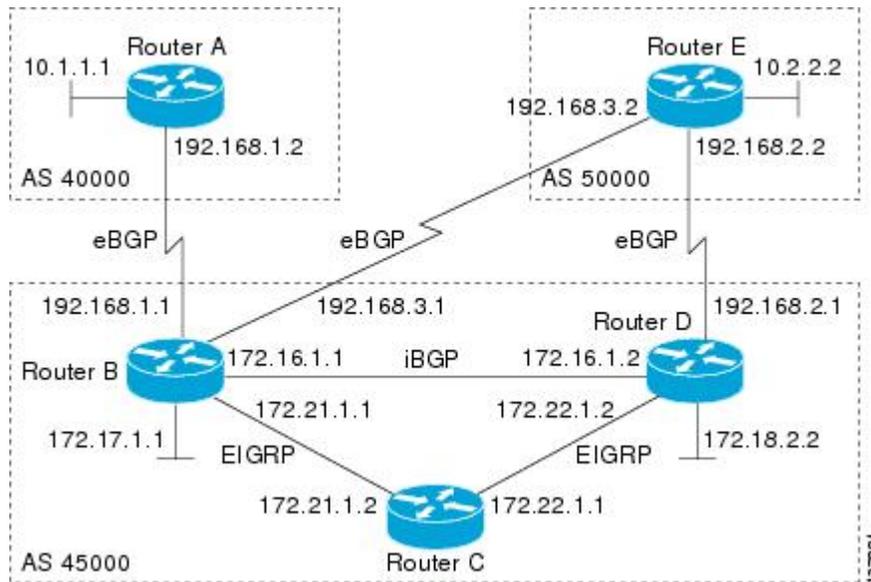
What to Do Next

If a BGP topology configuration is required, proceed to the Activating an MTR Topology by Using BGP section.

Activating an MTR Topology by Using BGP

Perform this task to activate an MTR topology inside an address family by using BGP. This task is configured on Router B in the figure below and must also be configured on Router D and Router E. In this task, a scope hierarchy is configured to apply globally, and a neighbor is configured under router scope configuration mode. Under the IPv4 unicast address family, an MTR topology that applies to video traffic is activated for the specified neighbor. There is no interface configuration mode for BGP topologies.

Figure 8: BGP Network Diagram



- Be familiar with all the concepts in the Information About BGP Support for MTR section on page 2.
- Configure and activate a global MTR topology configuration.



Note

- Redistribution within a topology is permitted. Redistribution from one topology to another is not permitted. This restriction is designed to prevent routing loops. You can use topology translation or topology import functionality to move routes from one topology to another.
- Only a single multicast topology can be configured, and only the base topology can be specified if a multicast topology is created.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *autonomous-system-number*
4. **scope** { **global** | **vrf** *vrf-name* }
5. **neighbor** { *ip-address* | *peer-group-name* } **remote-as** *autonomous-system-number*
6. **neighbor** { *ip-address* | *peer-group-name* } **transport**{ **connection-mode** { **active** | **passive** } | **path-mtu-discovery** | **multi-session** | **single-session** }
7. **address-family ipv4** [**mdt** | **multicast** | **unicast**]
8. **topology** { **base** | *topology-name* }
9. **bgp tid** *number*
10. **neighbor** *ip-address* **activate**
11. **neighbor** { *ip-address* | *peer-group-name* } **translate-topology** *number*
12. **end**
13. **clear ip bgp topology** { * | *topology-name* } { *as-number* | **dampening** [*network-address* [*network-mask*]] | **flap-statistics** [*network-address* [*network-mask*]] | **peer-group** *peer-group-name* | **table-map** | **update-group** [*number* | *ip-address*]] | **in** [**prefix-filter**] | **out** | **soft** [**in** [**prefix-filter**] | **out**]]
14. **show ip bgp topology** { * | *topology* } **summary**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	router bgp <i>autonomous-system-number</i> Example: Router(config)# router bgp 45000	Enters router configuration mode to create or configure a BGP routing process.
Step 4	scope { global vrf <i>vrf-name</i> } Example: Router(config-router)# scope global	Defines the scope to the BGP routing process and enters router scope configuration mode. <ul style="list-style-type: none"> • BGP general session commands that apply to a single network, or a specified VRF, are entered in this configuration mode. • Use the global keyword to specify that BGP uses the global routing table.

	Command or Action	Purpose
		<ul style="list-style-type: none"> Use the vrf keyword and <i>vrf-name</i> argument to specify that BGP uses a specific VRF routing table. The VRF must already exist.
Step 5	<p>neighbor {<i>ip-address</i> <i>peer-group-name</i>} remote-as <i>autonomous-system-number</i></p> <p>Example:</p> <pre>Router(config-router-scope)# neighbor 172.16.1.2 remote-as 45000</pre>	Adds the IP address of the neighbor in the specified autonomous system to the multiprotocol BGP neighbor table of the local router.
Step 6	<p>neighbor {<i>ip-address</i> <i>peer-group-name</i>} transport{connection-mode {active passive} path-mtu-discovery multi-session single-session}</p> <p>Example:</p> <pre>Router(config-router-scope)# neighbor 172.16.1.2 transport multi-session</pre>	<p>Enables a TCP transport session option for a BGP session.</p> <ul style="list-style-type: none"> Use the connection-mode keyword to specify the type of connection, either active or passive. Use the path-mtu-discovery keyword to enable TCP transport path maximum transmission unit (MTU) discovery. Use the multi-session keyword to specify a separate TCP transport session for each address family. Use the single-session keyword to specify that all address families use a single TCP transport session.
Step 7	<p>address-family ipv4 [mdt multicast unicast]</p> <p>Example:</p> <pre>Router(config-router-scope)# address- family ipv4</pre>	<p>Specifies the IPv4 address family and enters router scope address family configuration mode.</p> <ul style="list-style-type: none"> Use the mdt keyword to specify IPv4 MDT address prefixes. Use the multicast keyword to specify IPv4 multicast address prefixes. Use the unicast keyword to specify the IPv4 unicast address family. By default, the router is placed in address family configuration mode for the IPv4 unicast address family if the unicast keyword is not specified with the address-family ipv4 command. Non-topology-specific configuration parameters are configured in this configuration mode.
Step 8	<p>topology {base <i>topology-name</i>}</p> <p>Example:</p> <pre>Router(config-router-scope-af)# topology VIDEO</pre>	Configures the topology instance in which BGP routes class-specific or base topology traffic, and enters router scope address family topology configuration mode.
Step 9	<p>bgp tid <i>number</i></p> <p>Example:</p> <pre>Router(config-router-scope-af-topo)# bgp tid 100</pre>	<p>Associates a BGP routing process with the specified topology ID.</p> <ul style="list-style-type: none"> Each topology must be configured with a unique topology ID.
Step 10	neighbor <i>ip-address</i> activate	Enables the BGP neighbor to exchange prefixes for the NSAP address family with the local router.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router(config-router-scope-af-topo)# neighbor 172.16.1.2 activate</pre>	<p>NoteIf you have configured a peer group as a BGP neighbor, do not use this command because peer groups are automatically activated when any peer group parameter is configured.</p>
Step 11	<p>neighbor {<i>ip-address</i> <i>peer-group-name</i>} translate-topology <i>number</i></p> <p>Example:</p> <pre>Router(config-router-scope-af-topo)# neighbor 172.16.1.2 translate-topology 200</pre>	<p>(Optional) Configures BGP to install routes from a topology on another router to a topology on the local router.</p> <ul style="list-style-type: none"> The topology ID is entered for the <i>number</i> argument to identify the topology on the router.
Step 12	<p>end</p> <p>Example:</p> <pre>Router(config-router-scope-af-topo)# end</pre>	<p>(Optional) Exits router scope address family topology configuration mode and returns to privileged EXEC mode.</p>
Step 13	<p>clear ip bgp topology {<i>*</i> <i>topology-name</i>} {<i>as-number</i> dampening [<i>network-address</i> [<i>network-mask</i>]] flap-statistics [<i>network-address</i> [<i>network-mask</i>]] peer-group <i>peer-group-name</i> table-map update-group [<i>number</i> <i>ip-address</i>]} [in [prefix-filter] out] soft [in [prefix-filter] out]</p> <p>Example:</p> <pre>Router# clear ip bgp topology VIDEO 45000</pre>	<p>Resets BGP neighbor sessions under a specified topology or all topologies.</p>
Step 14	<p>show ip bgp topology {<i>*</i> <i>topology</i>} summary</p> <p>Example:</p> <pre>Router# show ip bgp topology VIDEO summary</pre>	<p>(Optional) Displays BGP information about a topology.</p> <ul style="list-style-type: none"> Most standard BGP keywords and arguments can be entered following the topology keyword. <p>NoteOnly the syntax required for this task is shown. For more details, see the <i>Cisco IOS IP Routing: BGP Command Reference</i>.</p>

- [What to Do Next, page 31](#)

What to Do Next

Repeat this task for every topology that you want to enable, and repeat this configuration on all neighbor routers that are to use the topologies.

If you want to import routes from one MTR topology to another on the same router, proceed to the Importing Routes from an MTR Topology by Using BGP section.

Importing Routes from an MTR Topology by Using BGP

**Note**

Perform this task to import routes from one MTR topology to another on the same router, when multiple topologies are configured on the same router. In this task, a prefix list is defined to permit prefixes from the 10.2.2.0 network, and this prefix list is used with a route map to filter routes moved from the imported topology. A global scope is configured, address family IPv4 is entered, the VIDEO topology is specified, the VOICE topology is imported, and the routes are filtered using the route map named 10NET.

- Configure and activate a global topology configuration.

**Note**

- Redistribution within a topology is permitted. Redistribution from one topology to another is not permitted. This restriction is designed to prevent routing loops from occurring. You can use topology translation or topology import functionality to move routes from one topology to another.
- Only a single multicast topology can be configured, and only the base topology can be specified if a multicast topology is created.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip prefix-list** *list-name* [**seq** *seq-value*] {**deny** *network / length*| **permit** *network / length*} [**ge** *ge-value*] [**le** *le-value*]
4. **route-map** *map-name* [**permit** | **deny**] [*sequence-number*]
5. **match ip address** {*access-list-number* [*access-list-number...* | *access-list-name...*] | *access-list-name* [*access-list-number...* | *access-list-name*] | **prefix-list** *prefix-list-name* [*prefix-list-name...*]}
6. **exit**
7. **router bgp** *autonomous-system-number*
8. **scope** {**global** | **vrf** *vrf-name*}
9. **address-family ipv4** [**mdt** | **multicast** | **unicast**]
10. **topology** {**base**| *topology-name*}
11. **import topology** {**base**| *topology-name*} [**route-map** *map-name*]
12. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal	Enters global configuration mode.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router# configure terminal</pre>	
Step 3	<p>ip prefix-list <i>list-name</i> [seq <i>seq-value</i>] {deny <i>network / length</i> permit <i>network / length</i>} [ge <i>ge-value</i>] [le <i>le-value</i>]</p> <p>Example:</p> <pre>Router(config)# ip prefix-list TEN permit 10.2.2.0/24</pre>	<p>Configures an IP prefix list.</p> <ul style="list-style-type: none"> In this example, prefix list TEN permits advertising of the 10.2.2.0/24 prefix depending on a match set by the match ip address command.
Step 4	<p>route-map <i>map-name</i> [permit deny] [<i>sequence-number</i>]</p> <p>Example:</p> <pre>Router(config)# route-map 10NET</pre>	<p>Creates a route map and enters route map configuration mode.</p> <ul style="list-style-type: none"> In this example, the route map named 10NET is created.
Step 5	<p>match ip address {<i>access-list-number</i> [<i>access-list-number...</i> <i>access-list-name...</i>] <i>access-list-name</i> [<i>access-list-number...</i> <i>access-list-name</i>] prefix-list <i>prefix-list-name</i> [<i>prefix-list-name...</i>]}</p> <p>Example:</p> <pre>Router(config-route-map)# match ip address prefix-list TEN</pre>	<p>Configures the route map to match a prefix that is permitted by a standard access list, an extended access list, or a prefix list.</p> <ul style="list-style-type: none"> In this example, the route map is configured to match prefixes permitted by prefix list TEN.
Step 6	<p>exit</p> <p>Example:</p> <pre>Router(config-route-map)# exit</pre>	<p>Exits route map configuration mode and returns to global configuration mode.</p>
Step 7	<p>router bgp <i>autonomous-system-number</i></p> <p>Example:</p> <pre>Router(config)# router bgp 50000</pre>	<p>Enters router configuration mode to create or configure a BGP routing process.</p>
Step 8	<p>scope {global vrf <i>vrf-name</i>}</p> <p>Example:</p> <pre>Router(config-router)# scope global</pre>	<p>Defines the scope to the BGP routing process and enters router scope configuration mode.</p> <ul style="list-style-type: none"> BGP general session commands that apply to a single network, or a specified VRF, are entered in this configuration mode. Use the global keyword to specify that BGP uses the global routing table. Use the vrf keyword and <i>vrf-name</i> argument to specify that BGP uses a specific VRF routing table. The VRF must already exist.

	Command or Action	Purpose
Step 9	address-family ipv4 [mdt multicast unicast] Example: <pre>Router(config-router-scope)# address-family ipv4</pre>	Enters router scope address family configuration mode to configure an address family session under BGP. <ul style="list-style-type: none"> Non-topology-specific configuration parameters are configured in this configuration mode.
Step 10	topology {base topology-name} Example: <pre>Router(config-router-scope-af)# topology VIDEO</pre>	Configures the topology instance in which BGP routes class-specific or base topology traffic, and enters router scope address family topology configuration mode.
Step 11	import topology {base topology-name} [route-map map-name] Example: <pre>Router(config-router-scope-af-topo)# import topology VOICE route-map 10NET</pre>	(Optional) Configures BGP to move routes from one topology to another on the same router. <ul style="list-style-type: none"> The route-map keyword can be used to filter routes that moved between topologies.
Step 12	end Example: <pre>Router(config-router-scope-af-topo)# end</pre>	(Optional) Exits router scope address family topology configuration mode and returns to privileged EXEC mode.

Configuring an MTR Topology in Interface Configuration Mode

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



Note

Interfaces cannot be excluded from the base topology by design. However, IGP can be excluded from an interface in a base topology configuration.

SUMMARY STEPS

- enable
- configure terminal
- interface *type number*
- topology ipv4 [multicast | unicast] {*topology-name*[disable] | base}
- end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Router(config)# interface Ethernet 0/0	Specifies the interface type and number, and enters interface configuration mode.
Step 4	topology ipv4 [multicast unicast] { <i>topology-name</i> [disable] base } Example: Router(config-if)# topology ipv4 VOICE	Enters interface topology configuration mode to configure an MTR topology instance on an interface. <ul style="list-style-type: none"> • Use the disable keyword to disable the topology instance on the interface. This form is used to exclude a topology configuration from an interface. • If the no form of this command is used, the topology interface configuration is removed. • If the no form of this command is used with the disable keyword, the topology instance is enabled on the interface.
Step 5	end Example: Router(config-if-topology)# end	Exits interface topology configuration mode and returns to privileged EXEC mode.

Activating an MTR Topology in Interface Configuration Mode by Using OSPF

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** [*interface-type interface-number*] [**brief**] [**multicast**] [**topology**] {*topology-name*|**base**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Router(config)# interface Ethernet 0/0	Specifies the interface type and number, and enters interface configuration mode.
Step 4	topology ipv4 [multicast unicast] { <i>topology-name</i> [disable] base }	Enters interface topology configuration mode to configure 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 <i>number</i> Example: Router(config-if-topology)# ip ospf cost 100	Applies a cost to the interface in a topology instance. <ul style="list-style-type: none"> • The lowest cost number has the highest preference.
Step 6	ip ospf topology disable Example: Router(config-if-topology)# ip ospf topology disable	Prevents OSPF from advertising the interface as part of the topology without disabling the OSPF process or the topology on the interface.

	Command or Action	Purpose
Step 7	end Example: Router(config-if-topology)# end	Exits interface topology configuration mode and returns to privileged EXEC mode.
Step 8	show ip ospf [<i>process-id</i>] interface [<i>interface-type</i> <i>interface-number</i>] [brief] [multicast] [topology { <i>topology-name</i> base }] Example: Router# show ip ospf 1 interface topology VOICE	(Optional) Displays OSPF-related interface information. <ul style="list-style-type: none"> Displays OSPF and interface information about the specified topology when the topology keyword is entered.

Activating an MTR Topology in Interface Configuration Mode by Using EIGRP

SUMMARY STEPS

- enable
- configure terminal
- interface *type number*
- topology ipv4 [**multicast** | **unicast**] {*topology-name*[**disable**] | **base**}
- eigrp *as-number* **delay** *value*
- eigrp *as-number* **next-hop-self**
- eigrp *as-number* **shutdown**
- eigrp *as-number* **split-horizon**
- eigrp *as-number* **summary-address** *ip-address wildcard-mask* [**distance**]
- end
- show ip eigrp topology *name* interfaces

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<p>interface <i>type number</i></p> <p>Example:</p> <pre>Router(config)# interface Ethernet 0/0</pre>	Specifies the interface type and number, and enters interface configuration mode.
Step 4	<p>topology ipv4 [multicast unicast] {<i>topology-name</i>[disable] base}</p> <p>Example:</p> <pre>Router(config-if)# topology ipv4 VOICE</pre>	<p>Configures an MTR topology instance on an interface and enters interface topology configuration mode.</p> <p>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.</p>
Step 5	<p>eigrp as-number delay value</p> <p>Example:</p> <pre>Router(config-if-topology)# eigrp 1 delay 100000</pre>	<p>Configures the delay value that EIGRP uses for interface metric calculation.</p> <ul style="list-style-type: none"> The <i>value</i> argument is entered in microseconds. The example configures an interface delay metric of 100 milliseconds.
Step 6	<p>eigrp as-number next-hop-self</p> <p>Example:</p> <pre>Router(config-if-topology)# eigrp 1 next-hop-self</pre>	<p>Configures an EIGRP process to advertise itself as the next hop.</p> <ul style="list-style-type: none"> This command is enabled by default.
Step 7	<p>eigrp as-number shutdown</p> <p>Example:</p> <pre>Router(config-if-topology)# eigrp 1 shutdown</pre>	Disables an EIGRP process on the interface without disabling the global topology configuration on the interface.
Step 8	<p>eigrp as-number split-horizon</p> <p>Example:</p> <pre>Router(config-if-topology)# eigrp 1 split-horizon</pre>	<p>Configures an EIGRP process to use split horizon.</p> <ul style="list-style-type: none"> This command is enabled by default.
Step 9	<p>eigrp as-number summary-address ip-address wildcard-mask [distance]</p> <p>Example:</p> <pre>Router(config-if-topology)# eigrp 1 summary-address 10.1.1.0 0.0.0.255</pre>	<p>Configures an EIGRP summary address.</p> <ul style="list-style-type: none"> An administrative distance of 5 is applied to EIGRP summary routes if the distance is not specified.
Step 10	<p>end</p> <p>Example:</p> <pre>Router(config-if-topology)# end</pre>	Exits interface topology configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
Step 11	show ip eigrp topology <i>name</i> interfaces Example: <pre>Router# show ip eigrp topology VOICE interfaces</pre>	Displays information about interfaces, on which EIGRP is configured, in a topology.

Activating an MTR Topology in Interface Configuration Mode by Using IS-IS

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

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface *type number***
4. **ip address *ip-address mask* [secondary]**
5. **ip router isis [*area-tag*]**
6. **topology ipv4 [multicast | unicast] {*topology-name* [disable | base]}**
7. **isis topology disable**
8. **topology ipv4 [multicast | unicast] {*topology-name* [disable | base]}**
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: <pre>Router> enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: <pre>Router(config)# interface Ethernet 2/0</pre>	Specifies the interface type and number, and enters interface configuration mode.
Step 4	ip address <i>ip-address mask</i> [secondary]	Sets a primary or secondary IP address for an interface.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router(config-if)# ip address 192.168.7.17 255.255.255.0</pre>	
Step 5	<p>ip router isis [<i>area-tag</i>]</p> <p>Example:</p> <pre>Router(config-if)# ip router isis</pre>	<p>Configures an IS-IS routing process for IP on an interface and attaches an area designator to the routing process.</p> <p>NoteIf a tag is not specified, a null tag is assumed and the process is referenced with a null tag.</p>
Step 6	<p>topology ipv4 [multicast unicast] {<i>topology-name</i> [disable base]}</p> <p>Example:</p> <pre>Router(config-if)# topology ipv4 DATA</pre>	<p>Configures an MTR topology instance on an interface and enters interface topology configuration mode.</p> <p>NoteIn this example, the topology instance DATA is configured for an MTR network that has a global topology named DATA.</p>
Step 7	<p>isis topology disable</p> <p>Example:</p> <pre>Router(config-if-topology)# isis topology disable</pre>	<p>(Optional) Prevents an IS-IS process from advertising the interface as part of the topology.</p> <p>NoteIn this example, the topology instance DATA will not advertise the interface as part of the topology.</p>
Step 8	<p>topology ipv4 [multicast unicast] {<i>topology-name</i> [disable base]}</p> <p>Example:</p> <pre>Router(config-if-topology)# topology ipv4 VOICE</pre>	<p>Configures an MTR topology instance on an interface.</p> <p>NoteIn this example, the topology instance VOICE is configured for an MTR network that has a global topology named “VOICE”.</p>
Step 9	<p>end</p> <p>Example:</p> <pre>Router(config-if-topology)# end</pre>	<p>Exits interface topology configuration mode and returns to privileged EXEC mode.</p>

Configuring SNMP Support for MTR

- [Associating an SNMP Context with a VRF for MTR, page 40](#)
- [Associating an SNMP Context with a Data Topology for MTR, page 41](#)
- [Associating an SNMP Context with a Routing Protocol for MTR, page 43](#)

Associating an SNMP Context with a VRF for MTR

- Enable SNMP.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip vrf *vrf-name***
4. **snmp context *context-name***
5. **end**
6. **show snmp context mapping**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip vrf <i>vrf-name</i> Example: Router(config)# ip vrf vrfA	Defines a VRF instance and enters VRF configuration mode.
Step 4	snmp context <i>context-name</i> Example: Router(config-vrf)# snmp context context-vrfA	Creates an SNMP context for MTR for a specific VRF.
Step 5	end Example: Router(config-af-topology)# end	Exits VRF configuration mode and returns to privileged EXEC mode.
Step 6	show snmp context mapping Example: Router# show snmp context mapping	(Optional) Displays information about SNMP contexts for MTR.

Associating an SNMP Context with a Data Topology for MTR

- Enable SNMP.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **global-address-family ipv4 [multicast | unicast]**
4. **topology {base | topology-name}**
5. **snmp context context-name**
6. **end**
7. **show snmp context mapping**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	global-address-family ipv4 [multicast unicast] Example: Router(config)# global-address-family ipv4	Enters global address family base topology configuration mode to configure the global topology. <ul style="list-style-type: none"> • The address family for the class-specific topology is specified in this step. The subaddress family can be optionally specified. Unicast is the default if no subaddress family is entered.
Step 4	topology {base topology-name} Example: Router(config-af)# topology VOICE	Configures the global topology instance and enters routing topology configuration mode.
Step 5	snmp context context-name Example: Router(config-af-topology)# snmp context comp-topol	Creates an SNMP context for MTR for a specific topology.
Step 6	end Example: Router(config-af-topology)# end	Exits routing topology configuration mode and returns to privileged EXEC mode.
Step 7	show snmp context mapping	(Optional) Displays information about SNMP contexts for MTR.

Command or Action	Purpose
Example: Router# show snmp context mapping	

Associating an SNMP Context with a Routing Protocol for MTR

- Enable SNMP.

SUMMARY STEPS

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

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	router ospf <i>process-id</i> [vrf <i>vrf-name</i>] Example: Router(config)# router ospf 1	Enables an OSPF routing process and enters router configuration mode. <ul style="list-style-type: none"> • You can configure support for multiple routing protocols.
Step 4	snmp context <i>context-name</i> Example: Router(config-router)# snmp context comp-prot	Creates an SNMP context for MTR for a specific topology under a routing protocol.

	Command or Action	Purpose
Step 5	address-family ipv4 [multicast unicast] Example: Router(config-router)# address-family ipv4	Enters global address family configuration mode to configure an OSPF address family session.
Step 6	topology { base <i>topology-name</i> tid <i>number</i> } Example: Router(config-router-af)# topology VOICE tid 10	Configures the global topology instance and enters router address family topology configuration mode.
Step 7	snmp context <i>context-name</i> Example: Router(config-router-af-topology)# snmp context comp-protocol	Creates an SNMP context for MTR for a specific topology under a routing protocol.
Step 8	end Example: Router(config-router-af-topology)# end	Exits router address family topology configuration mode and returns to privileged EXEC mode.
Step 9	show snmp context mapping Example: Router# show snmp context mapping	(Optional) Displays information about SNMP contexts for MTR.

Enabling and Monitoring MTR Topology Statistics Accounting

- [Enabling Topology Statistics Accounting for MTR, page 44](#)
- [Monitoring Interface and Topology IP Traffic Statistics for MTR, page 46](#)

Enabling Topology Statistics Accounting for MTR

- Enable CEF.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **global-address-family ipv4 [multicast | unicast]**
4. **topology accounting**
5. **exit**
6. **interface *type number***
7. **ip topology-accounting**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	global-address-family ipv4 [multicast unicast] Example: Router(config)# global-address-family ipv4	Enters global address family configuration mode.
Step 4	topology accounting Example: Router(config-af)# topology accounting	Enables topology accounting on all interfaces in the global address family for all IPv4 unicast topologies in the default VRF instance.
Step 5	exit Example: Router(config-af)# exit	Exits global address family configuration mode.
Step 6	interface <i>type number</i> Example: Router(config)# interface FastEthernet 1/10	Specifies the interface type and number, and enters interface configuration mode.
Step 7	ip topology-accounting	Enables topology accounting for all IPv4 unicast topologies in the VPN VRF associated with the specified interface.

	Command or Action	Purpose
	Example: Router(config-if)# ip topology-accounting	<ul style="list-style-type: none"> This topology accounting is supported only for the default VRF.
Step 8	end Example: Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Monitoring Interface and Topology IP Traffic Statistics for MTR

SUMMARY STEPS

- enable
- show ip interface [*type number*] [topology{*name* | all | base}] [stats]
- show ip traffic [topology{*name* | all | base}]
- clear ip interface *type number* [topology{*name* | all | base}] [stats]
- clear ip traffic [topology{*name* | all | base}]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	show ip interface [<i>type number</i>] [topology{ <i>name</i> all base}] [stats] Example: Router# show ip interface FastEthernet 1/10 stats	(Optional) Displays IP traffic statistics for all interfaces or statistics related to the specified interface. <ul style="list-style-type: none"> If you specify an interface type and number, you see information for that specific interface. If you specify no optional arguments, you see information for all the interfaces. If the topology name keyword and argument are used, statistics are limited to the IP traffic for that specific topology. The base keyword is reserved for IPv4 unicast base topology.
Step 3	show ip traffic [topology{ <i>name</i> all base}] Example: Router# 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. <ul style="list-style-type: none"> The base keyword is reserved for the IPv4 unicast base topology.
Step 4	clear ip interface <i>type number</i> [topology{ <i>name</i> all base}] [stats]	(Optional) Resets interface-level IP traffic statistics. <ul style="list-style-type: none"> If the topology keyword and a related keyword are not used, only the interface-level aggregate statistics are reset.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router# clear ip interface FastEthernet 1/10 topology all</pre>	<ul style="list-style-type: none"> If all topologies need to be reset, use the all keyword as the topology name.
Step 5	<p>clear ip traffic [topology {name all} base]]</p> <p>Example:</p> <pre>Router# clear ip traffic topology all</pre>	<p>(Optional) Resets IP traffic statistics.</p> <ul style="list-style-type: none"> If no topology name is specified, global statistics are cleared.

Testing Network Connectivity for MTR

SUMMARY STEPS

- enable**
- ping [vrf vrf-name | topology topology-name] protocol [target-address] [source-address]**
- traceroute [vrf vrf-name | topology topology-name] [protocol] destination**

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>enable</p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	<p>ping [vrf vrf-name topology topology-name] protocol [target-address] [source-address]</p> <p>Example:</p> <pre>Router# ping topology VOICE</pre>	<p>Configures the router to transmit ping messages to the target host in a topology.</p> <ul style="list-style-type: none"> An extended ping is configured by entering this command with only the topology name.
Step 3	<p>traceroute [vrf vrf-name topology topology-name] [protocol] destination</p> <p>Example:</p> <pre>Router# traceroute VOICE</pre>	<p>Configures the router to trace the specified host in a topology.</p> <ul style="list-style-type: none"> An extended trace is configured by entering this command with only the topology name. If the vrf vrf-name keyword and argument are used, the topology option is not displayed because only the default VRF is supported. The topology topology-name keyword and argument and the DSCP option in the extended traceroute system dialog are displayed only if there is a topology configured on the router.

Configuration Examples for Multi-Topology Routing

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Examples Unicast Topology for MTR

- [Example Global Interface Configuration, page 48](#)
- [Example Incremental Forwarding Configuration, page 48](#)
- [Example Unicast Topology Verification, page 49](#)

Example Global Interface Configuration

The following example shows how to create a topology instance named VOICE. This topology is configured to use all operational interfaces on the router. Per the default forwarding rule (strict), only packets destined for routes in the VOICE topology RIB are forwarded. Packets that do not have a topology-specific forwarding entry are dropped.

```
global-address-family ipv4
  topology VOICE
  all-interfaces
end
```

Example Incremental Forwarding Configuration

The following example shows how to create a topology instance named VIDEO. This topology is configured to accept and install a maximum of 1000 routes in the VIDEO topology RIB. Incremental forwarding mode is configured so that the router forwards packets over the base topology if no forwarding entry is found in the class-specific RIB.

```
global-address-family ipv4
  topology VIDEO
  forward-base
  maximum routes 1000 90
end
```

Example Unicast Topology Verification

The output of the **show topology detail** command displays information about class-specific and base topologies. This information includes the address family, associated interfaces, interface and topology status, topology name, and associated VRF.

```
Router# show topology detail

Topology: base
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Associated interfaces:
    Ethernet0/0, operation state: UP
    Ethernet0/1, operation state: DOWN
    Ethernet0/2, operation state: DOWN
    Ethernet0/3, operation state: DOWN
    Loopback0, operation state: UP
Topology: VIDEO
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Topology fallback is enabled
  Topology maximum route limit 1000, warning limit 90% (900)
  Associated interfaces:
Topology: VOICE
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Topology is enabled on all interfaces
  Associated interfaces:
    Ethernet0/0, operation state: UP
    Ethernet0/1, operation state: DOWN
    Ethernet0/2, operation state: DOWN
    Ethernet0/3, operation state: DOWN
    Loopback0, operation state: UP
Topology: base
  Address-family: ipv4 multicast
  Associated VPN VRF is default
  Topology state is DOWN
  Route Replication Enabled:
    from unicast all
  Associated interfaces:
```

Examples Multicast Topology for MTR

- [Example Route Replication Configuration, page 49](#)
- [Example Using a Unicast RIB for Multicast RPF Configuration, page 50](#)
- [Example Multicast Verification, page 50](#)

Example Route Replication Configuration

The following example shows how to enable multicast support for MTR and to configure a separate multicast topology:

```
ip multicast-routing
ip multicast rpf mult topology
!
global-address-family ipv4 multicast
  topology base
end
```

Example Using a Unicast RIB for Multicast RPF Configuration

The following example shows how to configure the multicast topology to replicate OSPF routes from the VOICE topology. The routes are filtered through the BLUE route map before they are installed in the multicast routing table.

```
ip multicast-routing
ip multicast rpf multitopology
!
access-list 1 permit 192.168.1.0 0.0.0.255
!
route-map BLUE
match ip address 1
exit
!
global-address-family ipv4 multicast
topology base
route-replicate from unicast topology VOICE ospf route-map BLUE
```

Example Using a Unicast RIB for Multicast RPF Configuration

The following example shows how to configure the multicast topology to perform RPF calculations on routes in the VIDEO topology RIB to build multicast distribution trees:

```
ip multicast-routing
ip multicast rpf multitopology
!
global-address-family ipv4 multicast
topology base
use-topology unicast VIDEO
end
```

Example Multicast Verification

The following example shows that the multicast topology is configured to replicate routes from the RIB of the VOICE topology:

```
Router# show topology detail
Topology: base
Address-family: ipv4
Associated VPN VRF is default
Topology state is UP
Associated interfaces:
  Ethernet0/0, operation state: UP
  Ethernet0/1, operation state: DOWN
  Ethernet0/2, operation state: DOWN
  Ethernet0/3, operation state: DOWN
  Loopback0, operation state: UP

Topology: VIDEO
Address-family: ipv4
Associated VPN VRF is default
Topology state is UP
Topology fallback is enabled
Topology maximum route limit 1000, warning limit 90% (900)
Associated interfaces:
Topology: VOICE
Address-family: ipv4
Associated VPN VRF is default
Topology state is UP
Topology is enabled on all interfaces
Associated interfaces:
  Ethernet0/0, operation state: UP
  Ethernet0/1, operation state: DOWN
  Ethernet0/2, operation state: DOWN
  Ethernet0/3, operation state: DOWN
  Loopback0, operation state: UP
Topology: base
```

```

Address-family: ipv4 multicast
Associated VPN VRF is default
Topology state is DOWN
Multicast multi-topology mode is enabled.
Route Replication Enabled:
  from unicast topology VOICE all route-map BLUE
Associated interfaces:

```

Examples MTR Traffic Classification

The following example shows how to configure classification and activate MTR for two topologies:

```

global-address-family ipv4
  topology VOICE
    all-interfaces
  exit
  topology VIDEO
    forward-base
    maximum routes 1000 90
  exit
  exit
class-map match-any VOICE-CLASS
  match ip dscp 9
  exit
class-map match-any VIDEO-CLASS
  match ip dscp af11
  exit
policy-map type class-routing ipv4 unicast MTR
  class VOICE-CLASS
    select-topology VOICE
  exit
  class VIDEO-CLASS
    select-topology VIDEO
  exit
  exit
global-address-family ipv4
  service-policy type class-routing MTR
end

```

The following example shows how to display detailed information about the VOICE and VIDEO topologies:

```

Router# show topology detail
Topology: base
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Associated interfaces:
    Ethernet0/0, operation state: UP
    Ethernet0/1, operation state: DOWN
    Ethernet0/2, operation state: DOWN
    Ethernet0/3, operation state: DOWN
    Loopback0, operation state: UP

Topology: VIDEO
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Topology fallback is enabled
  Topology maximum route limit 1000, warning limit 90% (900)
  Associated interfaces:

Topology: VOICE
  Address-family: ipv4
  Associated VPN VRF is default
  Topology state is UP
  Topology is enabled on all interfaces
  Associated interfaces:
    Ethernet0/0, operation state: UP
    Ethernet0/1, operation state: DOWN
    Ethernet0/2, operation state: DOWN

```

```

    Ethernet0/3, operation state: DOWN
    Loopback0, operation state: UP
Topology: base
Address-family: ipv4 multicast
Associated VPN VRF is default
Topology state is DOWN
Multicast multi-topology mode is enabled.
Route Replication Enabled:
  from unicast topology VOICE all route-map BLUE
Associated interfaces:
  Ethernet0/0, operation state: UP
  Ethernet0/1, operation state: DOWN
  Ethernet0/2, operation state: DOWN
  Ethernet0/3, operation state: DOWN
  Loopback0, operation state: UP

```

The following example shows how to display the classification values for the VOICE and VIDEO topologies:

```
Router# show mtm table
```

```

MTM Table for VRF: default, ID:0
Topology          Address Family  Associated VRF  Topo-ID
base              ipv4            default         0
VOICE             ipv4            default         2051
Classifier: ClassID:3
DSCP: cs1
DSCP: 9
VIDEO             ipv4            default         2054
Classifier: ClassID:4
DSCP: af11

```

Examples Activating an MTR Topology by Using OSPF

The following example shows how to configure the VOICE topology in an 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.

```

Router# 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 msec
Minimum hold time between two consecutive SPF's 10000 msec
Maximum wait time between two consecutive SPF's 10000 msec
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 Activating an MTR Topology by Using EIGRP

The following example shows how to activate the VIDEO topology using EIGRP:

```
router eigrp MTR
 address-family ipv4 autonomous-system 1
  network 10.0.0.0 0.0.0.255
  topology VIDEO tid 10
  redistribute connected
end
```

The following example shows how to display the status of routing protocols configured in the VIDEO topology. EIGRP information is shown in the output.

```
Router# show ip protocols topology VIDEO
*** IP Routing is NSF aware ***
Routing Protocol is "eigrp 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
  Redistributing: eigrp 1
  EIGRP graceful-restart disabled
  EIGRP NSF-aware route hold timer is 240s
  Topologies : 100(VOICE) 0(base)
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: internal 90 external 170
```

The following example shows the EIGRP routing table configured under the VIDEO topology:

```
Router# show ip eigrp topology VIDEO

EIGRP-IPv4 Topology Table for AS(1)/ID(10.1.1.2) Routing Table: VOICE
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status
P 10.1.1.0/24, 1 successors, FD is 281600
   via Connected, Ethernet0/0
```

Examples Activating an MTR Topology by Using IS-IS

The following example shows how to configure both the MTR topologies DATA and VIDEO and IS-IS support for MTR. The DATA and VIDEO topologies are enabled on three IS-IS neighbors in a network.

Router1

```
global-address-family ipv4
 topology DATA
 topology VOICE
end
interface Ethernet 0/0
 ip address 192.168.128.2 255.255.255.0
 ip router isis
 topology ipv4 DATA
 isis topology disable
 topology ipv4 VOICE
end
router isis
 net 33.3333.3333.3333.00
```

```
metric-style wide
address-family ipv4
topology DATA tid 100
topology VOICE tid 200
end
```

Router2

```
global-address-family ipv4
topology DATA
topology VOICE
all-interfaces
forward-base
maximum routes 1000 warning-only
shutdown
end
interface Ethernet 0/0
ip address 192.168.128.1 255.255.255.0
ip router isis
topology ipv4 DATA
isis topology disable
topology ipv4 VOICE
end
interface Ethernet 1/0
ip address 192.168.130.1 255.255.255.0
ip router isis
topology ipv4 DATA
isis topology disable
topology ipv4 VOICE
end
router isis
net 32.3232.3232.3232.00
metric-style wide
address-family ipv4
topology DATA tid 100
topology VOICE tid 200
end
```

Router 3

```
global-address-family ipv4
topology DATA
topology VOICE
all-interfaces
forward-base
maximum routes 1000 warning-only
shutdown
end
interface Ethernet 1/0
ip address 192.168.131.1 255.255.255.0
ip router isis
topology ipv4 DATA
isis topology disable
topology ipv4 VOICE
end
router isis
net 31.3131.3131.3131.00
metric-style wide
address-family ipv4
topology DATA tid 100
topology VOICE tid 200
end
```

Entering the **show isis neighbors detail** command verifies topology translation with the IS-IS neighbor Router1:

```
Router# show isis neighbors detail
System Id      Type Interface IP Address      State Holdtime Circuit Id
R1             L2   Et0/0         192.168.128.2   UP      28          R5.01
```

```

Area Address(es): 33
SNPA: aabb.cc00.1f00
State Changed: 00:07:05
LAN Priority: 64
Format: Phase V
Remote TID: 100, 200
Local TID: 100, 200

```

Examples Activating an MTR Topology by Using BGP

- [Example BGP Topology Translation Configuration, page 55](#)
- [Example BGP Scope Global and VRF Configuration, page 55](#)
- [Example BGP Topology Verification, page 56](#)

Example BGP Topology Translation Configuration

The following example shows how to configure BGP in the VIDEO topology and how to configure topology translation with the 192.168.2.2 neighbor:

```

router bgp 45000
scope global
neighbor 172.16.1.1 remote-as 50000
neighbor 192.168.2.2 remote-as 55000
neighbor 172.16.1.1 transport multi-session
neighbor 192.168.2.2 transport multi-session
address-family ipv4
topology VIDEO
bgp tid 100
neighbor 172.16.1.1 activate
neighbor 192.168.2.2 activate
neighbor 192.168.2.2 translate-topology 200
end
clear ip bgp topology VIDEO 50000

```

Example BGP Scope Global and VRF Configuration

The following example shows how to configure a global scope for a unicast topology and also for a multicast topology. After exiting the router scope configuration mode, a scope is configured for the VRF named DATA.

```

router bgp 45000
scope global
bgp default ipv4-unicast
neighbor 172.16.1.2 remote-as 45000
neighbor 192.168.3.2 remote-as 50000
address-family ipv4 unicast
topology VOICE
bgp tid 100
neighbor 172.16.1.2 activate
exit
address-family ipv4 multicast
topology base
neighbor 192.168.3.2 activate
exit
exit
exit
scope vrf DATA
neighbor 192.168.1.2 remote-as 40000
address-family ipv4
neighbor 192.168.1.2 activate
end

```

Example BGP Topology Verification

The following example shows summary output for the **show ip bgp topology** command. Information is displayed about BGP neighbors configured to use the MTR topology named VIDEO.

```
Router# show ip bgp topology VIDEO summary
BGP router identifier 192.168.3.1, local AS number 45000
BGP table version is 1, main routing table version 1
Neighbor      V    AS MsgRcvd MsgSent  TblVer  InQ  OutQ Up/Down  State/PfxRcd
172.16.1.2    4 45000   289    289     1    0    0 04:48:44      0
192.168.3.2   4 50000    3      3     1    0    0 00:00:27      0
```

The following partial output displays BGP neighbor information under the VIDEO topology:

```
Router# show ip bgp topology VIDEO neighbors 172.16.1.2
BGP neighbor is 172.16.1.2, remote AS 45000, internal link
  BGP version 4, remote router ID 192.168.2.1
  BGP state = Established, up for 04:56:30
  Last read 00:00:23, last write 00:00:21, hold time is 180, keepalive interval is 60
seconds
  Neighbor sessions:
    1 active, is multisession capable
  Neighbor capabilities:
    Route refresh: advertised and received(new)
  Message statistics, state Established:
    InQ depth is 0
    OutQ depth is 0

    Sent      Rcvd
  Opens:           1          1
  Notifications:   0          0
  Updates:         0          0
  Keepalives:     296        296
  Route Refresh:   0          0
  Total:          297        297
  Default minimum time between advertisement runs is 0 seconds
  For address family: IPv4 Unicast topology VIDEO
  Session: 172.16.1.2 session 1
  BGP table version 1, neighbor version 1/0
  Output queue size : 0
  Index 1, Offset 0, Mask 0x2
  1 update-group member
  Topology identifier: 100
  .
  .
  .
  Address tracking is enabled, the RIB does have a route to 172.16.1.2
  Address tracking requires at least a /24 route to the peer
  Connections established 1; dropped 0
  Last reset never
  Transport(tcp) path-mtu-discovery is enabled
  Connection state is ESTAB, I/O status: 1, unread input bytes: 0
  Minimum incoming TTL 0, Outgoing TTL 255
  Local host: 172.16.1.1, Local port: 11113
  Foreign host: 172.16.1.2, Foreign port: 179
  .
  .
  .
```

Example Importing Routes from an MTR Topology by Using BGP

The following example shows how to configure an access list to be used by a route map named BLUE to filter routes imported from the MTR topology named VOICE. Only routes with the prefix 192.168.1.0 are imported.

```
access-list 1 permit 192.168.1.0 0.0.0.255
route-map BLUE
```

```

match ip address 1
exit
router bgp 50000
scope global
neighbor 10.1.1.2 remote-as 50000
neighbor 172.16.1.1 remote-as 60000
address-family ipv4
topology VIDEO
bgp tid 100
neighbor 10.1.1.2 activate
neighbor 172.16.1.1 activate
import topology VOICE route-map BLUE
end
clear ip bgp topology VIDEO 50000

```

Examples MTR Topology in Interface Configuration Mode

The following example shows how to disable the VOICE topology on Ethernet interface 0/0.

```

interface Ethernet 0/0
topology ipv4 VOICE disable

```

Examples MTR OSPF Topology in Interface Configuration Mode

The following example shows how to disable OSPF routing on interface Ethernet 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.

```

Router# 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 **briefand topology** keywords to display information about the topologies configured for OSPF in interface configuration mode.

```

Router# 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

Examples MTR EIGRP Topology in Interface Configuration Mode

The following example shows how to set the EIGRP delay calculation on interface Ethernet 0/0 to 100 milliseconds:

```
interface Ethernet 0/0
 topology ipv4 VOICE
  eigrp 1 delay 100000
  eigrp 1 next-hop-self
  eigrp 1 shutdown
  eigrp 1 split-horizon
  eigrp 1 summary-address 10.1.1.0 0.0.0.255
end
```

The following example shows how to display EIGRP information about interfaces in the VOICE topology:

```
Router# show ip eigrp topology VOICE interfaces
```

```
EIGRP-IPv4 interfaces for process 1
Interface           Peers  Xmit Queue  Mean   Pacing Time  Multicast  Pending
                   Un/Reliable SRTT    Un/Reliable Flow Timer  Routes
Et0/0                1      0/0         20     0/2          0          0
```

The following example shows how to display EIGRP information about links in the VOICE topology:

```
Router# show ip eigrp topology VOICE detail-links
EIGRP-IPv4 Topology Table for AS(1)/ID(10.1.1.1) Routing Table: VOICE
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status
P 10.1.1.0/24, 1 successors, FD is 25856000, serno 5
   via Connected, Ethernet0/0
```

Examples MTR IS-IS Topology in Interface Configuration Mode

The following example shows how to prevent the IS-IS process from advertising interface Ethernet 1/0 as part of the DATA topology:

```
interface Ethernet 1/0
 ip address 192.168.130.1 255.255.255.0
 ip router isis
 topology ipv4 DATA
  isis topology disable
 topology ipv4 VOICE
end
```

Examples SNMP Support for MTR

In the following example, the context string “context-vrfA” is configured to be associated with vrfA and will be passed on to the MIB access function during SNMP transactions:

```
snmp-server community public
ip vrf vrfA
 snmp context context-vrfA
exit
```

In the following example, the context string “context-voice” is configured to be associated with the data topology named voice and will be passed on to the MIB access function during SNMP transactions:

```
global-address-family ipv4
 topology voice
  snmp context context-voice
exit
```

In the following example, the context strings “context-ospf” and “context-voice” are configured to be associated with the OSPF process and topology named voice and will be passed on to the MIB access function during SNMP transactions:

```
router ospf 3
 snmp context context-ospf
 address-family ipv4
 topology voice tid 10
 snmp context ospf-voice
 end
```

The following example shows how the context strings are mapped to the specified VRF, address family, topology, or protocol instance:

```
Router# show snmp context mapping
Context: ospf-voice
  VRF Name:
  Address Family Name: ipv4
  Topology Name: voice
  Protocol Instance: OSPF-3 Router
Context: context-ospf
  VRF Name:
  Address Family Name:
  Topology Name:
  Protocol Instance: OSPF-3 Router
Context: context-vrfa
  VRF Name: vrfa
  Address Family Name:
  Topology Name:
  Protocol Instance:
Context: context-voice
  VRF Name:
  Address Family Name: ipv4
  Topology Name: voice
  Protocol Instance:
```

Examples Monitoring Interface and Topology IP Traffic Statistics

In the following example, the **show ip interface** command is used with the *type number* arguments to display IP traffic statistics for the Fast Ethernet interface 1/10:

```
Router# show ip interface FastEthernet 1/10 stats
FastEthernet1/10
  5 minutes input rate 0 bits/sec, 0 packet/sec,
  5 minutes output rate 0 bits/sec, 0 packet/sec,
  201 packets input, 16038 bytes
  588 packets output, 25976 bytes
```

In this example, the **show ip traffic** command is used with the **topology instance** keyword and argument to display statistics related to a particular topology:

```
Router# show ip traffic topology VOICE
Topology: VOICE
  5 minute input rate 0 bits/sec, 0 packet/sec,
  5 minute output rate 0 bits/sec, 0 packet/sec,
  100 packets input, 6038 bytes,
  88 packets output, 5976 bytes.
```

Examples Testing Network Connectivity for MTR

The following example shows how to send a ping to the 10.1.1.2 neighbor in the VOICE topology:

```
Router# ping topology VOICE 10.1.1.2
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 10.1.1.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
```

The following example shows how to trace the 10.1.1.4 host in the VOICE topology:

```
Router# traceroute VOICE ip 10.1.1.4
Type escape sequence to abort.
Tracing the route to 10.1.1.4
 1 10.1.1.2 4 msec * 0 msec
 2 10.1.1.3 4 msec * 2 msec
 3 10.1.1.4 4 msec * 4 msec
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
MTR commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Cisco IOS Multi-Topology Routing Command Reference</i>
IP routing protocol commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Cisco IOS IP Routing: BGP Command Reference</i> <i>Cisco IOS IP Routing: EIGRP Command Reference</i> <i>Cisco IOS IP Routing: ISIS Command Reference</i> <i>Cisco IOS IP Routing: OSPF Command Reference</i>
IP multicast commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Cisco IOS IP Multicast Command Reference</i>
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Cisco IOS IP Quality of Service Solutions Command Reference</i>
IP routing protocols concepts and tasks	<i>Cisco IOS IP Routing: BGP Configuration Guide</i> <i>Cisco IOS IP Routing: EIGRP Configuration Guide</i> <i>Cisco IOS IP Routing: ISIS Configuration Guide</i> <i>Cisco IOS IP Routing: OSPF Configuration Guide</i>
IP multicast concepts and tasks	<i>Cisco IOS IP Multicast Configuration Guide</i>
QoS concepts and tasks	<i>Cisco IOS IP Quality of Service Solutions Configuration Guide</i>
Configuring Multitopology IS-IS for IPv6	<i>Implementing IS-IS for IPv6 module in the Cisco IOS IPv6 Configuration Guide</i>

Related Topic	Document Title
Cisco IOS In Service Software Upgrade Process	Cisco IOS In Service Software Upgrade module in the <i>Cisco IOS High Availability Configuration Guide</i>

Standards

Standard	Title
No new or modified standards are supported, and support for existing standards has not been modified.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported, and support for existing RFCs has not been modified.	--

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Multi-Topology Routing

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 <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

Table 1: Feature Information for Multi-Topology Routing

Feature Name	Releases	Feature Information
Multi-Topology Routing	12.2(33)SRB 15.0(1)S	<p>MTR introduces the capability to configure service differentiation through class-based forwarding. MTR provides multiple logical topologies over a single physical network. Service differentiation can be achieved by forwarding different traffic types over different logical topologies that could take different paths to the same destination. MTR can be used, for example, to define separate topologies for voice, video, and data traffic classes.</p> <p>The following commands were introduced or modified: all-interfaces, clear ip interface, clear ip route topology, clear ip traffic, debug topology, exit-global-af, exit-if-topology, exit-topo, forward-base, global-address-family ipv4, ip route topology, ip topology accounting, maximum routes, ping, route replicate, show ip interface, show ip protocols topology, show ip route topology, show ip static route, show ip static route summary, show ip traffic, show topology, shutdown, topology, topology accounting, traceroute.</p>
BGP Support for MTR	12.2(33)SRB 15.0(1)S	This feature provides BGP support for multiple logical

Feature Name	Releases	Feature Information
EIGRP Support for MTR	12.2(33)SRB 15.0(1)S	<p>topologies over a single physical network.</p> <p>The following commands were introduced or modified: address-family ipv4, bgp tid, clear ip bgp topology, import topology, neighbor translate-topology, neighbor transport, show ip bgp topology, scope, topology,</p>
IS-IS Support for MTR	12.2(33)SRB	<p>This feature provides EIGRP support for multiple logical topologies over a single physical network.</p> <p>The following commands were introduced or modified: address-family ipv4, eigrp delay, clear ip eigrp neighbor, eigrp next-hop-self, eigrp shutdown, eigrp split-horizon, eigrp summary-address, router eigrp, show ip eigrp topology, topology.</p>
IS-IS Support for MTR	12.2(33)SRB	<p>This feature provides IS-IS support for multiple logical topologies over a single physical network.</p> <p>The following commands were introduced or modified: address-family ipv4, isis topology disable, show isis neighbors, topology,</p>
ISSU--MTR	12.2(33)SRB1	<p>All protocols and applications that support MTR and also support ISSU have extended their ISSU support to include the MTR functionality.</p> <p>No commands were introduced or modified in this feature.</p>
MTR Support for Multicast	12.2(33)SRB 15.0(1)M	<p>This feature provides MTR support for multicast and allows the user to control the path of multicast traffic in the network.</p> <p>The following commands were introduced or modified: clear ip route multicast, ip multicast rpf</p>

Feature Name	Releases	Feature Information
		multitopology, show ip route multicast, use-topology.
OSPF Support for MTR	12.2(33)SRB	<p>This feature provides OSPF support for multiple logical topologies over a single physical network.</p> <p>The following commands were introduced or modified: address-family ipv4, area capability default-exclusion, ip ospf cost, ip ospf topology disable, ip ospf priority, router ospf, show ip ospf interface, show ip ospf topology-info, topology.</p>
QoS/MQC Support for MTR	12.2(33)SRB 15.0(1)S	<p>This feature enables MTR traffic classification. Traffic classification is used to associate different classes of traffic with different topologies when multiple topologies are configured on the same router. A subset of DSCP bits is used to encode classification values in the IP packet header and mark the packet for classification. When MTR traffic classification is enabled, MTR is activated and ready for the routing protocols to start contributing to the topologies.</p> <p>The following commands were introduced or modified: policy-map type class-routing ipv4 unicast, select topology, service-policy type class-routing, show mtm table, show policy-map type class-routing ipv4 unicast.</p>
SNMP Support for MTR	12.2(33)SRB 12.2(33)SB 15.0(1)S	<p>Context-based SNMP functionality has been integrated into Cisco IOS software and can be used to support MTR. SNMP support for MTR leverages context-based SNMP to extend support for existing MIBs from representing the management information for just the base</p>

Feature Name	Releases	Feature Information
		<p>topology to representing the same information for multiple topologies.</p> <p>The following commands were introduced or modified: show snmp context mapping, snmp context.</p>

Glossary

base topology --The entire network for which the usual set of routes are calculated. This topology is the same as the default global routing table that exists today without MTR being used.

class-specific topology --New topologies that are defined over and above the existing base topology; each class-specific topology is represented by its own RIB and FIB.

classification --Selection and matching of traffic that needs to be provided with a different treatment based on its mark. Classification is a read-only operation.

DSCP --DiffServ Code Point. Six bits in the ToS. (Two bits are now used for Explicit Congestion Notification.) These are the bits used to mark the packet.

incremental forwarding mode --Incremental forwarding mode is designed to support transitional or incremental deployment of MTR, where there are routers in the network that are not MTR enabled. In this mode, the router will look for a forwarding entry first in the class-specific FIB. If an entry is not found, the router will then look for the longest match in the base topology FIB. If an entry is found in the base topology FIB, the packet will be forwarded on the base topology. If a forwarding entry is not found in the base topology FIB, the packet is dropped.

marking --Setting a value in the packet or frame. Marking is a read and write operation.

multi-topology --Multi-topology means that each topology will route/forward a subset of the traffic as defined by the classification criteria.

NLRI --Network Layer Reachability Information.

strict forwarding mode --Strict forwarding mode is the default forwarding mode for MTR. Only routes in the topology specific routing table are considered. Among these, the longest match for the destination address is used. If no route containing the destination address can be found in the topology specific table, the packet is dropped.

TID --Topology Identifier. Each topology is configured with a unique topology ID. The topology ID is configured under the routing protocol and is used to identify and group NLRI for each topology in updates for a given protocol.

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