OSPFv3 Extensions for Mobile Ad Hoc Networks

Open Shortest Path First version 3 (OSPFv3) Extensions optimize OSPFv3 behavior for more efficient routing in Mobile Ad Hoc Networks (MANETs). The OSPFv3 extensions improve routing efficiency and reduce overhead traffic in MANET environments so that network clusters can scale to support more users. The OSPFv3 extensions boost performance for delay-sensitive, mission-critical voice, video, and data traffic, and it facilitates the integration of wireless MANETs with existing wire-line products.

Finding Feature Information

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

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

Prerequisites for OSPFv3 Extensions for MANETs

You must create the subscriber profile for PPP over Ethernet (PPPoE) service selection, assign the subscriber profile to a PPPoE profile, and enable PPPoE sessions on the interface. For details, see the "Mobile Ad Hoc Networks for Router-to-Radio Communications" module.

Information About OSPFv3 Extensions for MANETs

OSPFv3 Extensions Operation with MANETs

To optimize the use of OSPFv3 with MANETs, Cisco software implements extensions to OSPFv3 as defined in *draft-chandra-ospf-manet-ext-02* . The result is a well-understood routing protocol (OSPF) used in a network topology that is constantly changing and where bandwidth is limited.

OSPF is optimized in these ways:

- Tightly couples OSPFv3 with Radio Aware Routing (RAR)-compliant radios to provide faster convergence and reconvergence through neighbor presence indications and help determine accurate, real-time link metric costs.
- Minimizes OSPFv3 packet size by implementing incremental hellos.
- Minimizes the number of OSPFv3 packet transmissions by caching multicast link-state advertisements (LSAs).
- Implements optimized flooding (overlapping relay) functionality to minimize the number of flooded LSAs.
- Implements selective peering to reduce the OSPF network overhead by minimizing the number of redundant full adjacencies that an OSPF node maintains.

Radio-Aware Link-Metrics Tuning for OSPFv3

The RAR-compliant radio reports link-quality metrics to the router that are used by OSPFv3 as link metrics. You can fine-tune to adjust how these radio metrics are used by OSPFv3:

1. Configure how the radio-reported bandwidth, latency, resource, and relative link-quality metrics are converted to an OSPFv3 link cost.
2. Configure a hysteresis threshold on this resultant link cost to minimize the propagation of LSAs that report link-metric changes.

OSPFv3 receives raw radio-link data and computes a composite. In computing these metrics, you should consider these factors (see the figure "OSPF Cost Calculation for VMI Interfaces"):

- Maximum data rate--the theoretical maximum data rate of the radio link, in bytes per second
- Current data rate--the current data rate achieved on the link, in bytes per second
- Resources--a percentage (0 to100) that can represent the remaining amount of a resource (such as battery power)
- Latency--the transmission delay packets encounter, in milliseconds
- Relative link quality (RLQ)--a numeric value (0 to 100) representing relative quality, with 100 being the highest quality

You can weight metrics during the configuration process to emphasize or de-emphasize particular characteristics. For example, if throughput is a particular concern, you can weight the current data rate metric so that it is

factored more heavily into the composite metric. Similarly, you can omit a metric that is of no concern from the composite calculation.

Link metrics can change rapidly, often by very small degrees, which can result in a flood of meaningless routing updates. In a worst-case scenario, the network churns almost continuously as it struggles to react to minor variations in link quality. To alleviate this concern, you can use a tunable dampening mechanism to configure threshold values. Any metric change that falls below the threshold is ignored.

With the tunable hysteresis mechanism, you can adjust the threshold to the routing changes that occur when the router receives a signal that a new peer has been discovered, or that an existing peer is unreachable. The tunable metric is weighted and is adjusted dynamically to account for these characteristics:

- Current and maximum bandwidth
- Resources
- Latency
- Hysteresis

You can deconfigure individual weights and clear all weights so that the cost is returned to the default value for the interface type. Based on the routing changes that occur, the cost can be determined by the application of these metrics.

Dynamic Cost Metric for Virtual Multipoint Interfaces

The dynamic cost metric used for virtual multipoint interfaces (VMIs) is computed based on the Layer 2 (L2) feedback to Layer 3 (L3). The dynamic cost is calculated using this formula:

OC = maximum-data-rate

S1 = ospfv3 *process-id* cost dynamic weight throughput (bandwidth component)

S2 = ospfv3 *process-id* cost dynamic weight resources (resources component)

S3 = ospfv3 *process-id* cost dynamic weight latency (latency component)

S4 = ospfv3 *process-id* cost dynamic weight L2-factor (L2 factor component)

Throughput = (current-data-rate)/(maximum-data-rate)

Router-dynamic cost = OC + (S1) + (S2) + (S3) + (S4)

For a dynamic cost to have the same cost as a default cost, all parameters must equal zero.

Each Layer 2 feedback can contribute a cost in the range of 0 to 65535. To tune down this cost range, use the optional **weight** keyword with the **throughput**, **resources**, **latency**, or **L2-factor** keyword with the **ospfv3 cost** command. Each of these weights has a default value of 100 percent and can be configured in the range from 0 to 100. When 0 is configured for a specific weight, that weight does not contribute to the OSPF cost.

Because cost components can change rapidly, you might need to dampen the number of changes to reduce network-wide churn. Use the optional **hysteresis** keyword with the **threshold** *threshold-value* keyword and argument with the **ospfv3 cost** command to set a cost change threshold. Any cost change below this threshold is ignored.

You can use the **hysteresis** keyword to specify a hysteresis value based on the percentage of change of the currently stored value in the routing table for the peer.

Each time the router receives a new packet discovery quality (PADQ) packet from the radio for a peer, a new cost is calculated for it. The **hysteresis** keyword specifies the amount of change required before the router saves the new value.

The hysteresis percent calculated is performed as follows:

If the absolute value of (new_cost - saved_cost) is greater than (hysteresis_percent*saved_cost), then the new_cost is saved.

Because cost components can change rapidly, you might need to dampen the volume of changes to reduce network-wide churn. The recommended values for S2, S3, and S4 are based on network simulations that might reduce the rate of network changes. The recommended value for S1 is zero to eliminate this variable from the route cost calculation.

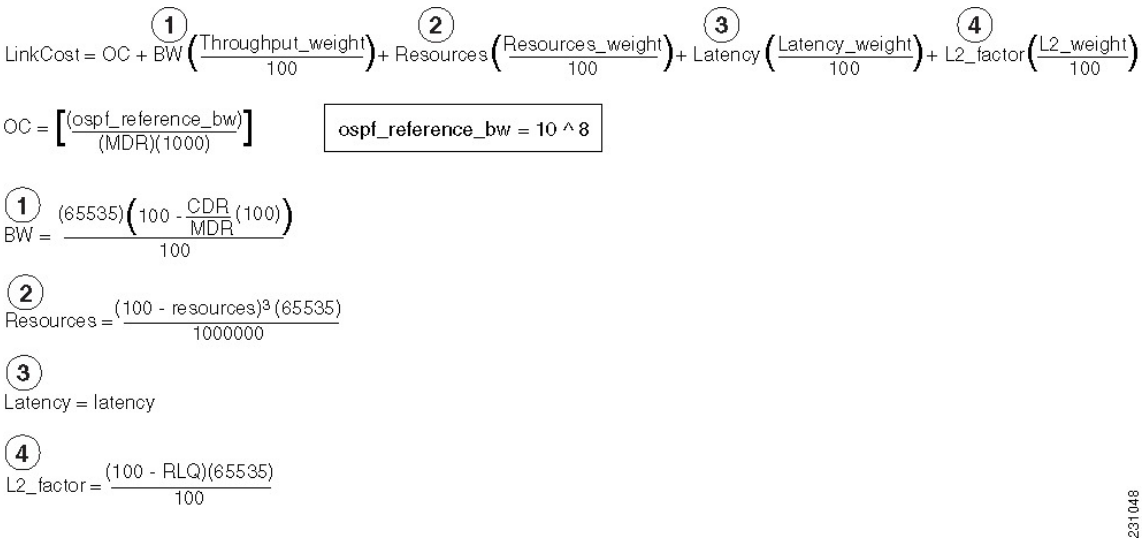
Each network might have unique characteristics that require different settings to optimize actual network performance, the table below lists the recommended cost settings intended as a starting point for optimizing an OSPFv3 network.

Table 1: Recommended Value Settings for OSPF Cost Metrics

Setting	Metric Command	Default Value	Recommended Value
S1	ospfv3 6 cost dynamic weight throughout	100	0
S2	ospfv3 6 cost dynamic weight resources	100	29
S3	ospfv3 6 cost dynamic weight latency	100	29
S4	ospfv3 6 cost dynamic weight L2-factor	100	29

The overall link cost is computed by using the formula shown in the figure below.

Figure 1: OSPF Cost Calculation for VMI Interfaces



To illustrate these settings, the following example shows how OSPF cost metrics might be defined for a VMI interface with one type of radio:

```
interface vmi1
```

```
ospfv3 6 cost dynamic weight throughput 0
ospfv3 6 cost dynamic hysteresis percent 10
ospfv3 6 cost dynamic weight resources 29
ospfv3 6 cost dynamic weight latency 29
ospfv3 6 cost dynamic hysteresis percent 10
ospfv3 6 cost dynamic weight L2-factor 29
```

Selective Peering

Selective peering reduces the OSPF network overhead by minimizing the number of redundant full adjacencies that an OSPF node maintains. Adjacencies to nodes that do not provide additional reachability can be kept in a two-way state. Selective peering reduces control-plane bandwidth utilization by reducing the number of database exchanges and routing updates.

Note Dataplane connectivity is not reduced when selective peering is enabled. User traffic flows over two-way links if they provide the best path through the network.

In the simplest example, selective peering determines if an adjacency should be formed when a new neighbor is discovered (a hello is received from a new neighbor). If the neighbor is not in the OSPF link state database, or if it is not reachable in the Shortest Path Tree (SPT), then the adjacency is formed. If the neighbor is in the OSPF link state database and is reachable, the neighbor is kept in the two-way state if the configured number of redundant paths to this neighbor is already formed.

Topology changes might cause the number of redundant paths to a given neighbor to fall below the configured level. When this occurs, selective peering can bring up adjacencies that were previously kept in the two-way state.

Selective peering takes link cost into consideration when determining which adjacencies to form. The objective is to have the reduced numbers of adjacencies formed over the lowest cost links. You can manually configure per-neighbor OSPF link costs, but with RAR-compliant radio interfaces, link costs are dynamically obtained from the radio through the VMI.

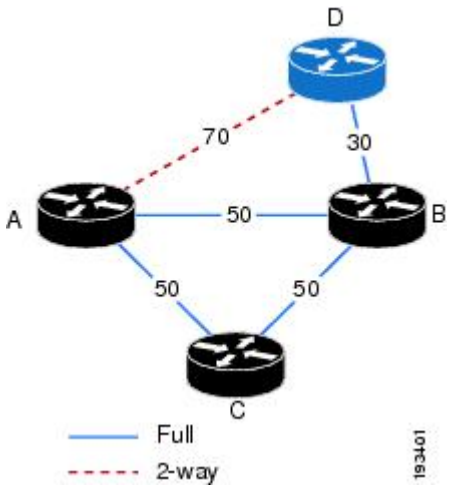
Selective Peering Link-Metrics Tuning

If the configured selective peering redundancy level is greater than 0, then at least two OSPFv3 control plane paths are maintained for every one hop neighbor. As new neighbors are discovered, full peering relationships are formed regardless of the link cost (as long as the cost satisfies the optionally configured minimum threshold specified in the **ospfv3 manet peering link-metrics** command).

As additional neighbors are brought to the full peering state to achieve the configured number of redundant paths to every neighbor, the router evaluates the path costs resulting from these new peering relationships to determine if they are incrementally better than the existing path costs. If they are not, the router keeps these links in a two-way state until other peering opportunities arise. The result is better path costs.

Consider the topology shown in the figure below. The configured redundancy level is 1 (the default), meaning that Router A attempts to maintain two paths to every one hop neighbor. Router A is in a full peering relationship with Router B and the link cost is 50. Router B is in a full peering relationship with Router D and the link cost is 30. Now Router D comes into radio range of Router A with a link cost of 70. Because the number of paths from Router A to Router D is currently 1 (through Router B), Router A brings this relationship to the full state.

Figure 2: Selective Peering with Link Metrics



You can keep Routers A and D in a two-way state until the link cost between them improves, or until another router comes into range that has better link costs to both of them. This can be achieved by configuring a redundant path cost threshold. In the figure above, if a redundant path cost threshold of 20 is configured, then Routers A and D will not transition to the full state until their link cost falls below the current path cost of 80 (50 + 30) minus 20, or 60. Because the depicted path cost is 70, the routers remain in the two-way state.

How to Configure OSPFv3 Extensions for MANETs

Configuring OSPFv3 in MANETs for Radio-Aware Routing

Perform this required task to create the VMI interface for OSPFv3 and associate it with the interface on which PPPoE is enabled. For OSPFv3 to take advantage of radio feedback, you must configure OSPFv3 MANET on the VMI. By default, VMI uses neighbor presence and link-metric data from the radio.

After you complete this task, you must fine-tune RAR link metrics as described in the Fine-Tuning Radio-Aware Routing Link Metrics, on page 9.

Before you begin

You must create a VMI interface and then assign the IPv6 or the IPv4 address to that VMI definition.

Note Do not assign any addresses to the corresponding physical interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no virtual-template subinterface**
4. **ipv6 unicast-routing**

5. **ipv6 cef**
6. **router ospfv3** *process-id*
7. **router-id** *ip-address*
8. **address-family ipv6 unicast**
9. **exit**
10. **exit**
11. **interface virtual-template** *number*
12. **ipv6 enable**
13. **no keepalive**
14. **exit**
15. **interface** *type number*
16. **ipv6 enable**
17. **ospfv3** *process-id* **area** *area-id* **ipv6** [**instance** *instance-id]*
18. **ospfv3** *process-id* **network manet**
19. **physical-interface** *type number*
20. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**no virtual-template subinterface** **Example:** `Router(config)# no virtual-template subinterface`	Disables the virtual template on the subinterface.
Step 4	**ipv6 unicast-routing** **Example:** `Router(config)# ipv6 unicast-routing`	Enables IPv6 unicast routing.
Step 5	**ipv6 cef** **Example:** `Router(config)# ipv6 cef`	Enables IPv6 Cisco Express Forwarding on the router.
Step 6	**router ospfv3** *process-id* **Example:**	Enables OSPFv3 for IPv6 router configuration mode, and enters router configuration mode.

	Command or Action	Purpose
	`Router(config)# router ospfv3 1`	
Step 7	**router-id** *ip-address* **Example:** `Router(config-router)# router-id 10.1.1.1`	Identifies a specific router rather than allowing the dynamic assignment of the router to occur.
Step 8	**address-family ipv6 unicast** **Example:** `Router(config-router)# address-family ipv6 unicast`	Specifies IPv6 unicast address prefixes and enters address family configuration mode.
Step 9	**exit** **Example:** `Router(config-router-af)# exit`	Returns to router configuration mode.
Step 10	**exit** **Example:** `Router(config-router)# exit`	Returns to global configuration mode.

Step 11	**interface virtual-template** *number*
	Example:
	`Router(config)#`
	`interface virtual-template 1`
		Enters interface configuration mode and creates a virtual template interface that can be configured and applied dynamically to virtual access interfaces.

Step 12	**ipv6 enable** **Example:** `Router(config-if)# ipv6 enable`	Enables IPv6 processing on the virtual template.
Step 13	**no keepalive** **Example:** `Router(config-if)# no keepalive`	Turns off PPP keepalive messages.
Step 14	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.
Step 15	**interface** *type number* **Example:**	Creates a VMI interface, and enters interface configuration mode.

	Command or Action	Purpose
	`Router(config)# interface vmi 1`	
Step 16	**ipv6 enable** **Example:** `Router(config-if)# ipv6 enable`	Enables IPv6 processing on the VMI interface that is not configured with an explicit IPv6 address.
Step 17	**ospfv3** *process-id* **area** *area-id* **ipv6** [**instance** *instance-id]* **Example:** `Router(config-if)# ospfv3 1 area 0 ipv6`	Attaches the interface to a specific OSPFv3 area and enables routing of IPv6 network traffic on this interface. • *process-id* --the value must match the ID configured with the **router ospfv3** global configuration command. • *instance-id* --automatically defaults to 0 for IPv6.
Step 18	**ospfv3** *process-id* **network manet** **Example:** `Router(config-if)# ospfv3 1 network manet`	Sets the network type to MANET.
Step 19	**physical-interface** *type number* **Example:** `Router(config-if)# physical-interface FastEthernet 0/1`	Creates the physical subinterface to be associated with the VMI interfaces on the router.
Step 20	**end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Fine-Tuning Radio-Aware Routing Link Metrics

Before you begin

Complete the required task in the Configuring OSPFv3 in MANETs for Radio-Aware Routing, on page 6.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ospfv3** *process-id* **cost dynamic hysteresis** [**threshold** *threshold-value* **]**
5. **ospfv3** *process-id* **cost dynamic weight throughput** *percent*
6. **ospfv3** *process-id* **cost dynamic weight resources** *percent*
7. **ospfv3** *process-id* **cost dynamic weight latency** *percent*

8. **ospfv3** *process-id* **cost dynamic weight L2-factor** *percent*
9. **ospfv3** *process-id* **area** *area-id* **ipv6** [**instance** *instance-id*]
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface vmi 1`	Creates a VMI interface, and enters interface configuration mode.
Step 4	**ospfv3** *process-id* **cost dynamic hysteresis** [**threshold** *threshold-value* **]** **Example:** `Router(config-if)# ospfv3 1 cost dynamic hysteresis threshold 1000`	Sets the hysteresis tolerance for the interface.
Step 5	**ospfv3** *process-id* **cost dynamic weight throughput** *percent* **Example:** `Router(config-if)# ospfv3 1 cost dynamic weight throughput 0`	Sets the metric for the throughput threshold.
Step 6	**ospfv3** *process-id* **cost dynamic weight resources** *percent* **Example:** `Router(config-if)# ospfv3 1 cost dynamic weight resources 29`	Sets the metric for the resource factor.
Step 7	**ospfv3** *process-id* **cost dynamic weight latency** *percent* **Example:** `Router(config-if)# ospfv3 1 cost dynamic weight latency 29`	Sets the threshold for the latency factor.

	Command or Action	Purpose
Step 8	**ospfv3** *process-id* **cost dynamic weight L2-factor** *percent* **Example:** `Router(config-if)# ospfv3 1 cost dynamic weight L2-factor 29`	Sets the metric for the Layer 2-to-Layer 3 delay factor.
Step 9	**ospfv3** *process-id* **area** *area-id* **ipv6** [**instance** *instance-id*] **Example:** `Router(config-if)# ospfv3 1 area 0 ipv6 instance 1`	Enables OSPF for IPv6 on an interface.
Step 10	**end** **Example:** `Router(config-if)# end`	(Optional) Returns to privileged EXEC mode.

Enabling Selective Peering

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router ospfv3** *process-id*
4. **address-family ipv6 unicast**
5. **exit**
6. **manet peering selective** [**redundancy** *redundancy-count*] [**per-interface]**
7. **end**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**router ospfv3** *process-id* **Example:** `Router(config)# router ospfv3 1`	Enables OSPFv3 for IPv6 router configuration mode, and enters router configuration mode.
Step 4	**address-family ipv6 unicast** **Example:** `Router(config-router)# address-family ipv6 unicast`	Specifies IPv6 unicast address prefixes.
Step 5	**exit** **Example:** `Router(config-router-af)# exit`	Returns to router configuration mode.
Step 6	**manet peering selective** [**redundancy** *redundancy-count*] [**per-interface]** **Example:** `Router(config-router)# manet peering selective`	Enables selective peering only for instances of the OSPF process for which the corresponding interface has been configured with the **ospfv3 network manet** command. • (Optional) **redundancy** *redundancy-count*--Changes the preferred number of redundant paths to any given peer. • (Optional) **per-interface**--Applies selective peering on a per-interface basis.
Step 7	**end** **Example:** `Router(config-router)# end`	(Optional) Returns to privileged EXEC mode.

Preventing Full Peering with Neighbors with Poor Link Metrics

An RAR-compliant radio might not advertise link metrics to the router before a new OSPFv3 neighbor is discovered. You can configure OSPFv3 to wait for link metrics before considering a neighbor for OSPFv3 peering. You can specify a minimum metric threshold. If the radio-reported link metric is above this threshold, the neighbor will be held in two-way state. With this configuration, full peering with neighbors with poor link metrics can be effectively prevented.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ospfv3** [*process-id*] **manet peering link-metrics** [*threshold*]
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface vmi 1`	Creates a VMI interface, and enters interface configuration mode.
Step 4	**ospfv3** [*process-id*] **manet peering link-metrics** [*threshold*] **Example:** `Router(config-if)# ospfv3 manet peering link-metrics 200`	Configures an OSPFv3 process to wait for link metrics from a neighbor before attempting selective peering with that neighbor. • (Optional) *threshold*--Specifies that the link cost computed from the received link metrics from the radio must be below this value. Otherwise, the neighbor is held in a two-way state until metrics are received that result in a link cost below the configured level. The range is 0 to 65535.
Step 5	**end** **Example:** `Router(config-if)# end`	Optional) Returns to privileged EXEC mode.

Fine-Tuning Selective Peering with Link Metrics

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ospfv3** [*process-id*] **manet peering cost** {**threshold** *threshold-value* | **percent** *percent-value*}
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface vmi 1`	Creates a VMI interface, and enters interface configuration mode.
Step 4	**ospfv3** [*process-id*] **manet peering cost** {**threshold** *threshold-value* | **percent** *percent-value*} **Example:** `Router(config-if)# ospfv3 1 manet peering cost percent 10`	Sets a minimum cost change threshold necessary before a new neighbor is considered for selective peering. • Requires redundant paths to have an incrementally better path cost than the current best path cost specified either as an absolute value or as a percentage of the current best path cost.
Step 5	**end** **Example:** `Router(config-if)# end`	(Optional) Returns to privileged EXEC mode.

Configuration Examples for OSPFv3 Extensions for MANETs

Example Configuring OSPFv3 in MANETs for Radio-Aware Routing

This example shows how to configure OSPFv3 in MANETs for use with RAR-compliant radios. For OSPFv3 to take advantage of radio feedback, OSPFv3 MANET is configured on the VMI.

```
!
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
service alignment detection
!
hostname Router1
!
boot-start-marker
boot-end-marker
!
```

```
no aaa new-model
!
ipv6 unicast-routing
ipv6 cef
subscriber authorization enable
!
subscriber profile pppoe_group_1
 pppoe service manet_radio
!
multilink bundle-name authenticated
!
no virtual-template subinterface
!
bba-group pppoe pppoe_group_1
 virtual-template 1
 service profile pppoe_group_1
!
interface Ethernet 0/1
 no ip address
 shutdown
!
interface Ethernet 0/2
 no ip address
 shutdown
!
interface Ethernet 0/3
 no ip address
 shutdown
!
interface Virtual-Template1
 no ip address
 ipv6 enable
 no peer default ip address
 no keepalive
!
interface vmi1
 no ip address
 ipv6 enable
 ospfv3 1 network manet
 ospfv3 1 area 0 ipv6
 physical-interface FastEthernet 0/0
!
ip forward-protocol nd
!
router ospfv3 1
!
log-adjacency-changes
address-family ipv6 unicast
exit-address-family
!
control-plane
!
line con 0
 exec-timeout 0 0
 line aux 0
 line vty 0 4
 login
!
```

Example Fine-Tuning Radio-Aware Routing Link Metrics

This example shows the OSPFv3 extensions for MANET configuration with fine-tuning radio-aware routing link metrics:

```
!
version 15.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router1
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
ip cef
ipv6 unicast-routing
ipv6 cef
!
subscriber authorization enable
!
subscriber profile pppoe_group_1
 pppoe service manet_radio
!
multilink bundle-name authenticated
!
no virtual-template subinterface
!
bba-group pppoe pppoe_group_1
 virtual-template 1
 service profile pppoe_group_1
!
interface Ethernet 0/0
 no ip address
 pppoe enable group pppoe_group_1
!
interface Ethernet 0/1
 no ip address
 shutdown
!
interface Ethernet 0/2
 no ip address
 shutdown
!
interface Ethernet 0/3
 no ip address
 shutdown
!
interface Virtual-Template1
 no ip address
 ipv6 enable
 no peer default ip address
 no keepalive
!
interface vmi1
 no ip address
 ipv6 enable
 ospfv3 1 area 0 ipv6
 ospfv3 1 network manet
```

```
 ospfv3 1 cost dynamic hysteresis threshold 1000
 ospfv3 1 cost dynamic weight throughput 0
 ospfv3 1 cost dynamic weight latency 29
 ospfv3 1 cost dynamic weight L2-factor 29
 ospfv3 1 area 0 ipv6 instance 1
 physical-interface Ethernet 0/1
!
router ospfv3 1
 router-id 10.1.1.1
 timers throttle spf 1000 2000 2000
 !
 address-family ipv6 unicast
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
logging esm config
!
!
control-plane
!
line con 0
 logging synchronous
line aux 0
line vty 0 4
 login
!
end
```

Example Enabling Selective Peering

This example shows the OSPFv3 extensions for MANET configuration when selective peering is enabled:

```
!
version 15.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router1
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
ip cef
ipv6 unicast-routing
ipv6 cef
!
subscriber authorization enable
!
subscriber profile pppoe_group_1
 pppoe service manet_radio
!
multilink bundle-name authenticated
!
no virtual-template subinterface
```

```
!
bba-group pppoe pppoe_group_1
 virtual-template 1
 service profile pppoe_group_1
!
interface Ethernet 0/0
 no ip address
 pppoe enable group pppoe_group_1
!
interface Ethernet 0/1
 no ip address
 shutdown
!
interface Ethernet 0/2
 no ip address
 shutdown
!
interface Ethernet 0/3
 no ip address
 shutdown
!
interface Virtual-Template1
 no ip address
 ipv6 enable
 no peer default ip address
 no keepalive
!
interface vmi1
 no ip address
 ipv6 enable
 ospfv3 1 area 0 ipv6
 ospfv3 1 network manet
 ospfv3 1 cost dynamic hysteresis threshold 1000
 ospfv3 1 cost dynamic weight throughput 0
 ospfv3 1 cost dynamic weight latency 29
 ospfv3 1 cost dynamic weight L2-factor 29
 ospfv3 1 area 0 ipv6 instance 1
 physical-interface Ethernet 0/1
!
router ospfv3 1
 router-id 10.1.1.1
 manet peering selective
 timers throttle spf 1000 2000 2000
 !
 address-family ipv6 unicast
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
logging esm config
!
!
control-plane
!
line con 0
 logging synchronous
line aux 0
line vty 0 4
 login
```

```
!
end
```

Example Preventing Full Peering with Neighbors with Poor Link Metrics

This example shows the OSPFv3 extensions for MANET configuration to prevent full peering with neighbors with poor link metrics:

```
!
version 15.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router1
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
ip cef
ipv6 unicast-routing
ipv6 cef
!
subscriber authorization enable
!
subscriber profile pppoe_group_1
 pppoe service manet_radio
!
multilink bundle-name authenticated
!
no virtual-template subinterface
!
bba-group pppoe pppoe_group_1
 virtual-template 1
 service profile pppoe_group_1
!
interface Ethernet 0/0
 no ip address
 pppoe enable group pppoe_group_1
!
interface Ethernet 0/1
 no ip address
 shutdown
!
interface Ethernet 0/2
 no ip address
 shutdown
!
interface Ethernet 0/3
 no ip address
 shutdown
!
interface Virtual-Template1
 no ip address
 ipv6 enable
 no peer default ip address
 no keepalive
!
interface vmi1
 no ip address
```

```
 ipv6 enable
 ospfv3 1 area 0 ipv6
 ospfv3 1 network manet
 ospfv3 1 cost dynamic hysteresis threshold 1000
 ospfv3 1 cost dynamic weight throughput 0
 ospfv3 1 cost dynamic weight latency 29
 ospfv3 1 cost dynamic weight L2-factor 29
 ospfv3 1 manet peering link-metrics 200
 ospfv3 1 area 0 ipv6 instance 1
 physical-interface Ethernet 0/1
!
router ospfv3 1
 router-id 10.1.1.1
 manet peering selective
timers throttle spf 1000 2000 2000
 !
 address-family ipv6 unicast
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
logging esm config
!
!
control-plane
!
line con 0
 logging synchronous
line aux 0
line vty 0 4
 login
!
end
```

Example Fine-Tuning Selective Peering with Link Metrics

This example shows the OSPFv3 extensions for MANET configuration to fine-tune selective peering with link metrics:

```
!
version 15.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router1
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
ip cef
ipv6 unicast-routing
ipv6 cef
!
subscriber authorization enable
!
```

```
subscriber profile pppoe_group_1
 pppoe service manet_radio
!
multilink bundle-name authenticated
!
no virtual-template subinterface
!
bba-group pppoe pppoe_group_1
 virtual-template 1
 service profile pppoe_group_1
!
interface Ethernet 0/0
 no ip address
 pppoe enable group pppoe_group_1
!
interface Ethernet 0/1
 no ip address
 shutdown
!
interface Ethernet 0/2
 no ip address
 shutdown
!
interface Ethernet 0/3
 no ip address
 shutdown
!
interface Virtual-Template1
 no ip address
 ipv6 enable
 no peer default ip address
 no keepalive
!
interface vmi1
 no ip address
 ipv6 enable
 ospfv3 1 area 0 ipv6
 ospfv3 1 network manet
 ospfv3 1 cost dynamic hysteresis threshold 1000
 ospfv3 1 cost dynamic weight throughput 0
 ospfv3 1 cost dynamic weight latency 29
 ospfv3 1 cost dynamic weight L2-factor 29
 ospfv3 1 manet peering cost percent 10
 ospfv3 1 manet peering link-metrics 200
 ospfv3 1 area 0 ipv6 instance 1
 physical-interface Ethernet 0/1
!
router ospfv3 1
 router-id 10.1.1.1
 manet peering selective
timers throttle spf 1000 2000 2000
 !
 address-family ipv6 unicast
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
logging esm config
!
!
```

```
control-plane
!
line con 0
 logging synchronous
line aux 0
line vty 0 4
 login
!
end
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Implementing IPv6 addressing and basic connectivity	*Cisco IOS IPv6 Configuration Guide*
IPv6	• *Cisco IOS IPv6 Configuration Guide* • *Cisco IOS IPv6 Command Reference*

Standards

Standard	Title
draft-chandra-ospf-manet-ext-02	*Extensions to OSPF to Support Mobile Ad Hoc Networking*

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	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
RFC 5578	*PPP over Ethernet (PPPoE) Extensions for Credit Flow and Link Metrics*
RFC 5820	*Extensions to OSPF to Support Mobile Ad Hoc Networks*

Technical Assistance

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

Feature Information for OSPFv3 Extensions for MANETs

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

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

Table 2: Feature Information for OSPFv3 Extensions for MANETs

Feature Name	Releases	Feature Information
OSPFv3 Extensions for MANETs	15.2(1)T	The OSPFv3 Extensions for MANETs feature optimizes OSPFv3 behavior for more efficient routing in highly mobile ad hoc environments. The following commands were introduced or modified: **manet cache**, **manet hello unicast**, **manet peering selective**, **manet willingness**, **ospfv3 manet peering cost**, **ospfv3 manet peering link-metrics**, **timers manet**, **timers throttle spf**.