



CHAPTER 20

Configuring IPv6

The Cisco MWR 2941 router provides support for a subset of the IPv6 features supported in Cisco IOS Release 15.1(1)S. The following sections describe the IPv6 features supported on the Cisco MWR 2941.

- [Supported IPv6 Features, page 20-1](#)
- [Supported IPv6 Commands, page 20-2](#)
- [Sample IPv6 Configurations, page 20-4](#)

Supported IPv6 Features

[Table 1](#) summarizes the supported IPv6 features in Release 15.0(1)MR. For information about how to configure these features, see the hyperlinked section or refer to the *IPv6 Configuration Guide, Cisco IOS Release 15.1S*.

Table 1 **Supported IPv6 Features**

| |
|--|
| Implementing IPv6 Addressing and Basic Connectivity |
| Implementing Bidirectional Forwarding Detection for IPv6 |
| Implementing IPv6 Bidirectional Forwarding Detection for IPv6 Border Gateway Protocol Neighbors. |
| Implementing Multiprotocol BGP for IPv6 |
| Implementing DHCP for IPv6 |
| Implementing IS-IS for IPv6 |
| Implementing IPv6 for Network Management |
| Implementing IPv6 over MPLS |
| Implementing IPv6 VPN over MPLS |
| Implementing OSPF for IPv6 |
| Implementing QoS for IPv6 |
| Implementing Static Routes for IPv6 |

IPv6 Limitations

For information about IPv6 limitations *Release Notes for Cisco MWR 2941-DC Mobile Wireless Edge Router, Release 15.1(1)MR*.

Supported IPv6 Commands

Table 2 summarizes the supported commands in Release 15.0(1)MR. For more information about these commands, refer to the *Cisco IOS IPv6 Command Reference*.

Table 2 Supported IPv6 Commands

| | | |
|-------------------------------|----------------------------------|-------------------------------------|
| aaa new-model | ipv6 ospf hello-interval | show clock |
| address-family ipv6 | | |
| bfd interval | | |
| clear cef table | ipv6 ospf mtu-ignore | show ipv6 cef |
| clear ipv6 dhcp binding | ipv6 ospf name-lookup | show ipv6 cef adjacency |
| clear ipv6 dhcp client | ipv6 ospf neighbor | show ipv6 cef non-recursive |
| clear ipv6 dhcp conflict | ipv6 ospf network | show ipv6 cef platform |
| clear ipv6 dhcp relay binding | ipv6 ospf priority | show ipv6 cef summary |
| clear ipv6 mtu | ipv6 ospf retransmit-interval | show ipv6 cef switching statistics |
| clear ipv6 neighbors | ipv6 ospf transmit-delay | show ipv6 cef traffic prefix-length |
| clear ipv6 route | ipv6 prefix-list | show ipv6 cef tree |
| clear ipv6 traffic | ipv6 prefix-list sequence-number | show ipv6 cef vrf |
| crypto key generate rsa | ipv6 route | show ipv6 dhcp |
| debug ipv6 cef drop | ipv6 route static bfd | show ipv6 dhcp binding |
| debug ipv6 cef events | ipv6 router ospf | show ipv6 dhcp conflict |
| debug ipv6 cef receive | ipv6 source-route | show ipv6 dhcp database |
| debug ipv6 cef table | ipv6 unicast-routing | show ipv6 dhcp interface |
| debug ipv6 dhcp | match dscp | show ipv6 dhcp pool |
| debug ipv6 dhcp database | match protocol | show ipv6 interface |
| debug ipv6 icmp | match protocol (zone) | show ipv6 mtu |
| debug ipv6 nd | maximum-paths (IPv6) | show ipv6 neighbors |
| debug ipv6 packet | mpls ldp router-id | show ipv6 ospf |
| hostname | neighbor activate | show ipv6 ospf border-routers |
| ip address | neighbor ebgp-multihop | show ipv6 ospf database |
| | neighbor fall-over bfd | |
| ip unnumbered | neighbor remote-as | show ipv6 ospf event |
| ipv6 address | neighbor send-community | show ipv6 ospf flood-list |
| ipv6 address anycast | neighbor send-label | show ipv6 ospf graceful-restart |

Table 2 Supported IPv6 Commands

| | | |
|---|--|-------------------------------------|
| ipv6 address autoconfig | neighbor translate-update | show ipv6 ospf interface |
| ipv6 address | ipv6 unicast-routing | show ipv6 ospf neighbor |
| ipv6 address eui-64 | neighbor update-source | |
| ipv6 address link-local | network (BGP and multiprotocol BGP) | show ipv6 ospf request-list |
| ipv6 cef | network (IPv6) | show ipv6 ospf retransmission-list |
| ipv6 cef accounting | passive-interface (IPv6) | show ipv6 ospf statistics |
| ipv6 dhcp database | ping | show ipv6 ospf summary-prefix |
| ipv6 dhcp pool | ping ipv6 | show ipv6 ospf timers rate-limit |
| ipv6 dhcp server | ping vrf | show ipv6 ospf traffic |
| ipv6 enable | prefix-delegation | show ipv6 ospf virtual-links |
| ipv6 hop-limit | prefix-delegation pool | show ipv6 protocols |
| ipv6 host | set dscp | show ipv6 route |
| ipv6 icmp error-interval | show adjacency | show ipv6 route summary |
| ipv6 mtu | show bfd neighbors | show ipv6 route vrf |
| ipv6 nd advertisement-interval | show bfd IPv6 summary | show ipv6 routers |
| ipv6 nd cache interface-limit (global) | show bgp ipv6 unicast | show ipv6 static |
| ipv6 nd cache interface-limit (interface) | show bgp ipv6 community | show ipv6 traffic |
| ipv6 nd dad attempts | show bgp ipv6 community-list | show isis database |
| ipv6 nd dad time | show bgp ipv6 unicast dampening dampened-paths | show isis ipv6 rib |
| ipv6 nd managed-config-flag | show bgp ipv6 filter-list | show isis spf-log |
| ipv6 nd ns-interval | show bgp ipv6 flap-statistics | show isis topology |
| ipv6 nd other-config-flag | show bgp ipv6 inconsistent-as | show key chain |
| ipv6 nd prefix | show bgp ipv6 labels | show mpls forwarding-table |
| ipv6 nd ra interval | show bgp ipv6 neighbors | ssh |
| ipv6 nd ra lifetime | show bgp ipv6 paths | summary-prefix (IPv6 OSPF) |
| ipv6 nd ra suppress | show bgp ipv6 peer-group | synchronization (IPv6) |
| ipv6 nd reachable-time | show bgp ipv6 prefix-list | telnet |
| ipv6 nd router-preference | show bgp ipv6 quote-regexp | telnet |
| ipv6 neighbor | show bgp ipv6 regexp | timers lsa arrival |
| ipv6 ospf area | show bgp ipv6 route-map | timers pacing flood (IPv6) |
| ipv6 ospf authentication | show bgp ipv6 summary | timers pacing lsa-group (IPv6) |
| ipv6 ospf bfd | show bgp vpnv6 unicast | timers pacing retransmission (IPv6) |
| ipv6 ospf cost | show cdp entry | timers spf (IPv6) |
| ipv6 ospf database-filter all out | show cdp neighbors | timers throttle lsa |

Table 2 Supported IPv6 Commands

| | | |
|---------------------------|---------------------|---------------------|
| ipv6 ospf dead-interval | show cef | timers throttle spf |
| ipv6 ospf demand-circuit | show cef interface | traceroute |
| ipv6 ospf encryption | show cef table | vrf definition |
| ipv6 ospf flood-reduction | show clns neighbors | vrf forwarding |

Sample IPv6 Configurations

The following sections provide sample configurations for IPv6.

- [Basic Connectivity](#)
- [Static Route](#)
- [BFD](#)
- [Multiprotocol BGP](#)
- [DHCP](#)
- [IS-IS](#)
- [Network Management](#)
- [IPv6 over MPLS](#)
- [IPv6 VPN over MPLS](#)
- [OSPFv3](#)
- [QoS](#)

This section displays partial configurations intended to demonstrate specific features.

Basic Connectivity

The following example shows how to enable IPv6 on the router.

```
ipv6 unicast-routing
ipv6 cef
ipv6 address
```

For more information about configuring basic IPv6 connectivity, refer to [Implementing IPv6 Addressing and Basic Connectivity](#).

Static Route

The following example shows how to configure an IPv6 static route on the Cisco MWR 2941.

```
Router# configure terminal
Router(config)# ipv6 route 2001:DB8::/64 102::2
Router(config)# exit
Router#
```

For more information about how to configure static routes for IPv6, see [Implementing Static Routes for IPv6](#).

BFD

The following examples show how to configure BFD for IPv6.

- [Example: Specifying an IPv6 Static BFDv6 Neighbor](#)

- [Example: Associating an IPv6 Static Route with a BFDv6 Neighbor](#)
- [Example: Displaying OSPF Interface Information about BFD](#)
- [Example: IPv6 VPN Configuration Using IPv4 Next Hop](#)

Example: Specifying an IPv6 Static BFDv6 Neighbor

The following example specifies a fully configured IPv6 static BFDv6 neighbor. The interface is Ethernet 0/0 and the neighbor address is 2001::1.

```
Router(config)# ipv6 route static bfd ethernet 0/0 2001:DB8:1::1
```

Example: Associating an IPv6 Static Route with a BFDv6 Neighbor

In this example, the IPv6 static route 2001:0DB8::/32 is associated with the BFDv6 neighbor 2001:DB8:1::1 over the Ethernet 0/0 interface:

```
Router(config)# ipv6 route static bfd ethernet 0/0 2001:DB8:1::1
Router(config)# ipv6 route 2001:0DB8::/32 ethernet 0/0 2001:DB8:1::1
```

Example: Displaying OSPF Interface Information about BFD

The following display shows that the OSPF interface is enabled for BFD:

```
Router# show ipv6 ospf interface

Serial10/0 is up, line protocol is up
  Link Local Address 2001:DB8:1::1, Interface ID 42
  Area 1, Process ID 1, Instance ID 0, Router ID 10.0.0.1
  Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT, BFD enabled
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:07
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/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 10.1.0.1
  Suppress hello for 0 neighbor(s)
```

For more information about how to configure BFD, refer to [Implementing Bidirectional Forwarding Detection for IPv6](#).

Multiprotocol BGP

Example: IPv6 VPN Configuration Using IPv4 Next Hop

The following example illustrates a 6VPE next hop:

```
interface Loopback0
  ip address 192.168.2.11 255.255.255.255
!
router bgp 100
  neighbor 192.168.2.10 remote-as 100
  neighbor 192.168.2.10 update-source Loopback0
!

address-family vpnv6
  neighbor 192.168.2.10 activate
```

```
neighbor 192.168.2.10 send-community extended
exit-address-family
```

By default, the next hop advertised will be the IPv6 VPN address:

```
[0:0]::FFFF:192.168.2.10
```

Note that it is a 192-bit address in the format of [RD]::FFFF:IPv4-address.

When the BGP IPv6 VPN peers share a common subnet, the MP_REACH_NLRI attribute contains a link-local address next hop in addition to the global address next hop. This situation typically occurs in an interautonomous-system topology when ASBRs are facing each other. In that case, the link-local next hop is used locally, and the global next hop is readvertised by BGP.

The BGP next hop is the keystone for building the label stack. The inner label is obtained from the BGP NLRI, and the outer label is the label distribution protocol (LDP) label to reach the IPv4 address embedded into the BGP next hop.

For more information about how to configure multiprotocol BGP, refer to [Implementing Multiprotocol BGP for IPv6](#).

DHCP

The following examples show how to configure DHCP for IPv6:

- [Stateful DHCP—Server](#)
- [Stateful DHCP—Client](#)
- [Stateless DHCP—Server](#)
- [Stateless DHCP—Client](#)

Stateful DHCP—Server

```
ipv6 dhcp pool dhcp-pool
prefix-delegation pool client-prefix-pool1 lifetime 1800 600
dns-server 2001:0DB8:3000:3000::42
domain-name example.com
```

```
interface vlan 102
ipv6 address 102::2/64
ipv6 dhcp server dhcp-pool
ipv6 local pool client-prefix-pool1 2001:0DB8:1200::/48 48
```

Stateful DHCP—Client

```
interface vlan 102
ipv6 dhcp client pd prefix-from-provider
interface vlan 101
ipv6 address prefix-from-provider 2001:0DB8::5:0:0:0:100/64
```

Stateless DHCP—Server

```
ipv6 dhcp pool dhcp-pool
dns-server 2001:0DB8:3000:3000::42
domain-name example.com
```

```
interface vlan 102
ipv6 address 2001:0DB8:1234:42::1/64
ipv6 dhcp server dhcp-pool
```

Stateless DHCP—Client

```
interface vlan 102
```

```
ipv6 address autoconfig
```

For more information about how to configure DHCP, refer to [Implementing DHCP for IPv6](#).

IS-IS

The following example shows how to configure IS-IS routing for IPv6 traffic.

```
interface Vlan306
  mtu 4470
  ip address 10.36.1.1 255.255.255.0
  no ptp enable
  ipv6 address 2001:DB8:1::1/64
  ipv6 enable
  ipv6 router isis isis-600-1
  mpls ip
  bfd interval 150 min_rx 50 multiplier 3
  !
router isis isis-600-1
  net net 2001:DB8.0000.0000.0003.00
  bfd all-interfaces
  !
  address-family ipv6
    maximum-paths 3
  exit-address-family
  !
```

For more information about how to configure IS-IS for IPv6, refer to [Implementing IS-IS for IPv6](#).

Network Management

```
aaa new-model
ip domain name example.com
username myusername password 0 mypassword
crypto key generate rsa
  int vlan 102
ipv6 address 2001:DB8::2/64
```

For more information about how to configure network management for IPv6, refer to [Implementing IPv6 for Network Management](#).

IPv6 over MPLS

The following example shows how to configure IPv6 over MPLS.

```
router bgp 100
  bgp router-id 192.168.1.1
  bgp log-neighbor-changes
  no bgp default route-target filter
  no bgp default ipv4-unicast
  neighbor 10.0.4.4 remote-as 100
  neighbor 10.0.4.4 update-source Loopback0
  !
  address-family ipv4
    neighbor 10.0.4.4 activate
    no auto-summary
  exit-address-family
  !
  address-family ipv6
    redistribute ospf 6
    network 2001:DB8:0::/64
    network 2001:DB8:1::/64

  neighbor 10.0.4.4 activate
```

```

    neighbor 10.0.4.4 send-label
  exit-address-family
!
```

For more information about how to configure IPv6 over MPLS, refer to [Implementing IPv6 over MPLS](#).

IPv6 VPN over MPLS

The following example shows how to configure an IPv6 VPN over MPLS (6VPE).

```

vrf definition B
rd 52:62

address-family ipv4
  route-target export 52:62
  route-target import 52:62
exit-address-family
!
address-family ipv6
  route-target export 52:62
  route-target import 52:62
exit-address-family
!

vrf definition C
rd 53:63
!
address-family ipv4
  route-target export 53:63
  route-target import 53:63
exit-address-family
!
address-family ipv6
  route-target export 53:63
  route-target import 53:63
exit-address-family

interface Vlan52
vrf forwarding B
ipv6 address 2001:DB8:0:1/64
ipv6 enable
!
interface Vlan53
vrf forwarding C
ipv6 address 2001:DB8:1:1/64
ipv6 enable
!

router bgp 100
  bgp router-id 1.1.1.1
  bgp log-neighbor-changes
  no bgp default route-target filter
  no bgp default ipv4-unicast
  neighbor 10.10.4.4 remote-as 100
  neighbor 10.10.4.4 update-source Loopback0
  !
  address-family ipv4
    neighbor 10.10.4.4 activate
    no auto-summary
  exit-address-family
  !
  address-family vpnv6
    neighbor 10.10.4.4 activate
```



```

neighbor 10.10.4.4 send-community both
exit-address-family
!
address-family ipv6 vrf B
  redistribute connected
  redistribute static
exit-address-family
!
address-family ipv6 vrf C
  neighbor 2001:DB8:100:1:: remote-as 104
  neighbor 2001:DB8:100:1:: activate

exit-address-family

```

For more information about how to configure IPv6 VPN over MPLS, see [Implementing IPv6 VPN over MPLS](#).

OSPFv3

The following example shows to to configure OSPF version 3 in order to route IPv6 traffic.

```

!
interface Vlan405
 ip address 192.168.1.2 255.255.255.0
 no ptp enable
 ipv6 address 2001:DB8:1::2/64
 ipv6 ospf 600 area 200
 mpls ip
 bfd interval 250 min_rx 100 multiplier 3

ipv6 router ospf 600
 router-id 10.0.5.6
 bfd all-interfaces
 event-log size 5 one-shot
 timers throttle spf 200 500 5000
 timers throttle lsa 0 20 5000
 timers lsa arrival 15
 timers pacing flood 15
!

```

For more information about how to configure OSPF v3, see [Implementing OSPF for IPv6](#).

QoS

The following partial configuration examples show how to use QoS features on a network with IPv4 and IPv6 traffic:

- [Applying Ingress QoS to IPv6 Traffic](#)
- [Applying Ingress QoS to IPv4 Traffic](#)
- [Applying Ingress QoS to IPv4 and IPv6 Traffic](#)
- [Applying Egress QoS to IPv4 and IPv6 Traffic](#)

Applying Ingress QoS to IPv6 Traffic

The following example classifies IPv6 traffic based on DSCP value and marks the traffic with a CoS and QoS group value.

```

class-map match-all ipv6_llq
 match protocol ipv6
 match dscp af43 af41 cs6 cs7
class-map match-all ipv6_premium

```

```

    match protocol ipv6
    match dscp af33, af13
class-map match-all ipv6_hsps
    match protocol ipv6
    match dscp af12

policy-map input-policy
class ipv6_llq
    set cos 5
    set qos-group 5
class ipv6_prem
    set qos-group 4
    set cos 4
class ipv6_hsps
    set cos 3
    set qos-group 3

interface GigabitEthernet0/4
switchport access vlan 1000
switchport mode access
service-policy input input-policy

```

Applying Ingress QoS to IPv4 Traffic

The following example classifies IPv4 traffic based on DSCP value and marks the traffic with a CoS and QoS group value.

```

class-map match-all ipv4_proto
    match protocol ip
    match dscp af11 af23 af33 af43

policy-map input-policy
class ipv4_proto
    set cos 5
    set qos-group 5

interface GigabitEthernet0/4
switchport access vlan 1000
switchport mode access
service-policy input input-policy

```

Applying Ingress QoS to IPv4 and IPv6 Traffic

The following example classifies both IPv4 and IPv6 traffic based on the DSCP value and marks the traffic with a CoS and QoS group value.

```

class-map match-any llq
    match dscp ef
    match dscp af43
    match dscp af41
    match dscp cs7
    match dscp cs6

policy-map input-policy
class llq
    set cos 5
    set qos-group 5

interface GigabitEthernet0/4
switchport access vlan 1000
switchport mode access
service-policy input input-policy

```

Applying Egress QoS to IPv4 and IPv6 Traffic

The following example performs the following QoS functions:

- Matches all IPv4 and IPv6 traffic based on QoS group
- Applies egress queuing based on QoS group
- Applies egress shaping to all traffic

```
class-map match-all q0
  match qos-group 0
class-map match-all q1
  match qos-group 1
class-map match-all q2
  match qos-group 2
class-map match-all q3
  match qos-group 3

policy-map child_policy_egress
  class q3
    priority percent 60
  class q2
    bandwidth remaining percent 50
  class q1
    bandwidth remaining percent 45
  class q0
    bandwidth remaining percent 4
policy-map parent_policy_egress
  class class-default
    shape average 380000000
    service-policy child_policy_egress

interface GigabitEthernet0/5
  switchport trunk allowed vlan 331
  switchport mode trunk
  service-policy output parent_policy_egress
```

For more information about how to configure QoS for IPv6, see [Implementing QoS for IPv6](#).

