Loop-Free Alternate Fast Reroute

Loop-Free Alternate (LFA) Fast Reroute (FRR) is a mechanism that provides local protection for unicast traffic in order to rapidly converge traffic flows around link and/or node failures.

Prerequisites for Loop-Free Alternate Fast Reroute

- Any of the following protocols must be supported for Loop-Free Alternate Fast Reroute:
  - Intermediate System-to-Intermediate System (IS-IS)
  - Open Shortest Path First (OSPF)
- While configuring ISIS protocol, **isis network point-to-point** must be configured.

Restrictions for Loop-Free Alternate Fast Reroute

- Logical interfaces namely Port-channel (PoCH) support LFA FRR and remote LFA-FRR, with a single member link. Port-channel can be used as a backup path.
- Micro loops may form due to traffic congestion.
- A Multiprotocol Label Switching (MPLS) traffic engineering (TE) tunnel cannot be used as a protected interface. However, an MPLS-TE tunnel can be a protecting (repair) interface as long as the TE tunnel is used as a primary path.

- For TDM psuedowires, the interfaces supported are CEM (CESoP, SAToP) and IMA (PVC,PVP); supported both on OC-3 and T1/E1 controllers. A maximum of 500 VCs can be configured per OC-3 controller.
- Each bridge domain interface (BDI) protected by FRR can have only one EFP.
- Remote LFA FRR provides better convergence with SFP ports rather than copper ports. As a workaround for copper ports, BFD triggered FRR can be used.
- FRR is *not* supported with POS and serial interfaces.
- Scale limit for FRR-protected global prefixes is 1500 and for layer 3 VPNs, scale limit is 4000.

Information About Loop-Free Alternate Fast Reroute

The Loop-Free Alternate (LFA) Fast Reroute (FRR) feature offers an alternative to the MPLS Traffic Engineering Fast Reroute feature to minimize packet loss due to link or node failure.

LFA FRR enables a backup route to avoid traffic loss if a network fails. The backup routes (repair paths) are precomputed and installed in the router as the backup for the primary paths. After the router detects a link or adjacent node failure, it switches to the backup path to avoid traffic loss.

LFA is a node other than the primary neighbor. Traffic is redirected to an LFA after a network failure. An LFA makes the forwarding decision without any knowledge of the failure. An LFA must neither use a failed element nor use a protecting node to forward traffic. An LFA must not cause loops. By default, LFA is enabled on all supported interfaces as long as the interface can be used as a primary path.

Advantages of using per-prefix LFAs are as follows:

- The repair path forwards traffic during transition when the primary path link is down.
- All destinations having a per-prefix LFA are protected. This leaves only a subset (a node at the far side of the failure) unprotected.

Supported Information

- LFA FRR is supported with equal cost multipath (ECMP).
- Fast Reroute triggered by Bidirectional Forwarding (BFD) is supported.
- Remote LFA tunnels are High Availability aware; hence, Stateful Switchover (SSO) compliant.

Benefits of Loop-Free Alternate Fast Reroute

- Same level of protection from traffic loss
- Simplified configuration
- Link and node protection
- Link and path protection
- LFA (loop-free alternate) paths

- Support for both IP and Label Distribution Protocol (LDP) core
- LFA FRR is supported with equal cost multipath (ECMP).
- Fast Reroute triggered by Bidirectional Forwarding (BFD).
- Remote LFA tunnels are High Availability aware; hence, Stateful Switchover (SSO) compliant.

LFA FRR and Remote LFA FRR over Bridge Domains Interfaces

The router supports bridge domain interfaces (BDI). For information on configuring bridge domains, see Configuring Ethernet Virtual Connections on the Cisco ASR 903 Router.

LFA FRR and remote LFA FRR is supported on bridge domain interfaces on the router. For information on configuring Remote LFA FRR on BDI, see How to Configure Loop-Free Alternate Fast Reroute, on page 6.

IS-IS and IP FRR

When a local link fails in a network, IS-IS recomputes new primary next-hop routes for all affected prefixes. These prefixes are updated in the RIB and the Forwarding Information Base (FIB). Until the primary prefixes are updated in the forwarding plane, traffic directed towards the affected prefixes are discarded. This process can take hundreds of milliseconds.

In IP FRR, IS-IS computes LFA next-hop routes for the forwarding plane to use in case of primary path failures. LFA is computed per prefix.

When there are multiple LFAs for a given primary path, IS-IS uses a tiebreaking rule to pick a single LFA for a primary path. In case of a primary path with multiple LFA paths, prefixes are distributed equally among LFA paths.

Repair Paths

Repair paths forward traffic during a routing transition. When a link or a router fails, due to the loss of a physical layer signal, initially, only the neighboring routers are aware of the failure. All other routers in the network are unaware of the nature and location of this failure until information about this failure is propagated through a routing protocol, which may take several hundred milliseconds. It is, therefore, necessary to arrange for packets affected by the network failure to be steered to their destinations.

A router adjacent to the failed link employs a set of repair paths for packets that would have used the failed link. These repair paths are used from the time the router detects the failure until the routing transition is complete. By the time the routing transition is complete, all routers in the network revise their forwarding data and the failed link is eliminated from the routing computation.

Repair paths are precomputed in anticipation of failures so that they can be activated the moment a failure is detected.

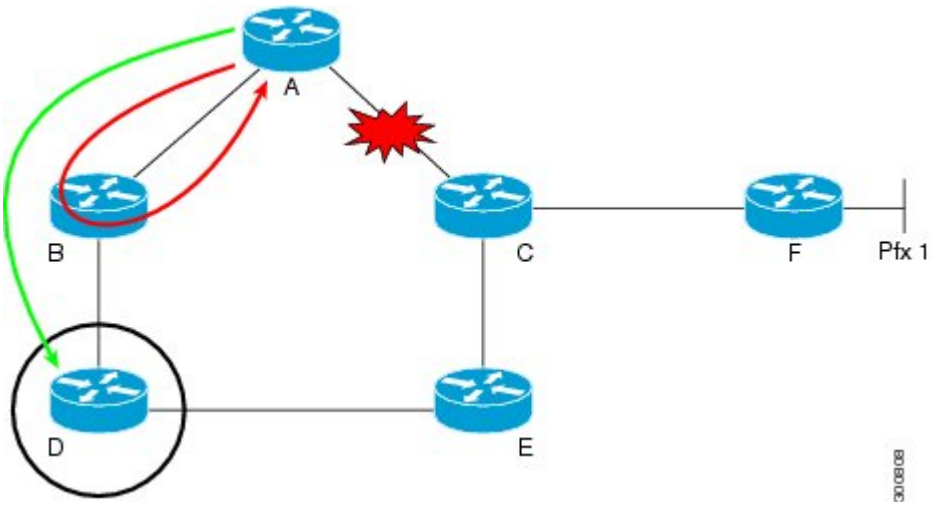
The IPv4 LFA FRR feature uses the following repair paths:

- Equal Cost Multipath (ECMP) uses a link as a member of an equal cost path-split set for a destination. The other members of the set can provide an alternative path when the link fails.
- LFA is a next-hop route that delivers a packet to its destination without looping back. Downstream paths are a subset of LFAs.

Remote LFA FRR

Some topologies (for example the commonly used ring-based topology) require protection that is not afforded by LFA FRR alone. Consider the topology shown in the figure below:

Figure 1: Remote LFA FRR with Ring Topology



The red looping arrow represents traffic that is looping immediately after a failure between node A and C (before network reconvergence). Device A tries to send traffic destined to F to next-hop B. Device B cannot be used as an LFA for prefixes advertised by nodes C and F. The actual LFA is node D. However, node D is not directly connected to the protecting node A. To protect prefixes advertised by C, node A must tunnel the packet around the failed link A-C to node D, provided that the tunnel does not traverse the failing link.

Remote LFA FRR enables you to tunnel a packet around a failed link to a remote loop-free alternate that is more than one hop away. In the figure above, the green arrow between A and D shows the tunnel that is automatically created by the remote LFA feature to bypass looping.

Remote LFA FRR for TDM and ATM Psuedowires

The Router supports two pseudowire types that utilize CEM transport: Structure-Agnostic TDM over Packet (SAToP) and Circuit Emulation Service over Packet-Switched Network (CESoPSN).

Border Gateway Protocol (BGP) Prefix-Independent Convergence (PIC) and LFA FRR Integration

Both the Labeled Border Gateway Protocol (BGP) Prefix-Independent Convergence (PIC) feature and the Loop-Free Alternate (LFA) Fast Reroute (FRR) feature can be configured together on the router.

BGP PIC is supported for bridge domain interfaces (BDI) with FRR.

Note Each bridge domain interface (BDI) protected by FRR can have only one EFP.

For information on configuring BGP PIC, see BGP PIC Edge for IP and MPLS-VPN.

Remote LFA FRR with VPLS

VPLS (Virtual Private LAN Service) enables enterprises to link together their Ethernet-based LANs from multiple sites via the infrastructure provided by their service provider. For information on configuring VPLS, see Configuring Virtual Private LAN Services. Starting With Cisco IOS XE Release 3.10S, Remote LFA FRR is supported with VPLS.

For information on configuring remote LFA FRR with VPLS, see How to Configure Loop-Free Alternate Fast Reroute, on page 6.

Remote LFA for MLDP

Table 1: Feature History Table

Feature Name	Release Information	Description
Remote LFA for MLDP	Cisco IOS XE Bengaluru 17.6.1	Remote Loop-Free Alternate (RLFA) based Fast Reroute (FRR) improves LFA coverage. When used with Multicast Label Distribution Protocol (MLDP) for IPv4, there's no need for an extra protocol in the control plane.

Loop-Free Alternate (LFA) FRR mechanism enables a backup route to avoid traffic loss if a network fails. The backup routes are precomputed and installed in the router as backup for primary paths. After the Cisco router detects a link or adjacent node failure, it switches to the backup path to avoid traffic loss. As the backup paths are pre-calculated and installed, switching to back up path is fast, in case of failure.

Effective Cisco IOS XE Bengaluru 17.6.1, you can enable this feature to effectively use backup routes to help with load balancing. This feature improves the LFA coverage when used with MPLS LDP (MLDP), there's no need of an extra protocol in the control plane.

Restrictions for Remote LFA for MLDP

- MLDP Node protection is not supported.
- Only Link Level protection for MLDP LFA FRR is supported.
- The detection of local/ remote link failure and switch over to the repair path is performed within 100 msec irrespective of the FRR scale.
- RLFA FRR in MLDP for IPv6 is not supported.
- RLFA FRR for Port-channel is not supported.
- Maximum supported Data Multicast Distribution Trees (MDT) for RLFA FRR is 750.
- Make Before Break (MBB) timer should be configured based on the scale of prefixes and P2MP trees configured.
- Label Distribution Protocol (LDP), Graceful Restart (GR) and MBB are mandatory to manage new and old Label Switch Path (LSP).
- Duplicate traffic is observed during cutover until GR timer expires. Duplicate traffic is dropped in the merge node and is not received by the receiver.

- RLFA over ECMP paths for mLDP is not supported.
- You must configure microloop avoidance under the IGP instance to achieve the desired convergence parameters.

Note Microloop avoidance may not work when Interior Gateway Protocol (IGP) is not receiving the interface down event to trigger the microloop avoidance timer. In such cases to avoid traffic drop due to IGP convergence, you have to configure BFD over the RLFA enabled links with 3.3-msec link down timers. This enables BFD to send link down notification within 9.9 msecs.

How to Configure Loop-Free Alternate Fast Reroute

To enable loop-free alternate fast reroute support for L2VPNs, VPLS, TDM pseudowires and VPWS, you must configure LFA FRR for the routing protocol. You can enable LFA FRR using ISIS or OSFP configurations.

- For information on configuring LFA FRR using OSPF, see OSPFv2 Loop-Free Alternate Fast Reroute in the *IP Routing: OSPF Configuration Guide*.
- For information on configuring Remote LFA FRR using OSPF, seeOSPF IPv4 Remote Loop-Free Alternate IP Fast Reroute in the *IP Routing: OSPF Configuration Guide*.
- For information on configuring Remote LFA FRR using ISIS on the Cisco ASR 903, see Configuring IS-IS Remote Loop-Free Alternate Fast Reroute, on page 6.

Configuring IS-IS Remote Loop-Free Alternate Fast Reroute

The following additional configurations are mandatory:

- **mpls ldp discovery targeted-hello accept**

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router isis** [*area-tag*] **Example:**	Enables the IS-IS routing protocol and specifies an IS-IS process. • Enters router configuration mode.

	Command or Action	Purpose
	`Device(config)# router isis ipfrr`	
Step 4	**fast-reroute per-prefix** {**level-1** | **level-2**} {**all** | **route-map** *route-map-name*} **Example:** `Device (config-router)# fast-reroute per-prefix level-1 all`	Enables per-prefix FRR. • Configure the **all** keyword to protect all prefixes.
Step 5	**fast-reroute remote-lfa** {**level-1** | **level-2**} **mpls-ldp** [**maximum-metric** *metric-value*] **Example:** `Device(config-router)# fast-reroute remote-lfa level-1 mpls-ldp`	Configures an FRR path that redirects traffic to a remote LFA tunnel for either level 1 or level 2 packets. • Use the **maximum-metric** *metric-value* keyword-argument pair to specify the maximum metric value required to reach the release node.
Step 6	**end** **Example:** `Device(config-router)# end`	Exits router configuration mode and enters privileged EXEC mode.

Recommended Configurations ISIS

For optimal results with remote LFA FRR, it is recommended that you use the following SFP timers:

- ISIS
  - spf-interval 5 50 200
  - prc-interval 5 50 200
  - sp-gen-interval 5 50 200
  - fast-flood 10
- Globally configure the MPLS IGP hold-down timer to avoid an indefinite wait by IGP for synchronization using the **mpls ldp igp sync holddown 2000** command.

Example: Configuring IS-IS Remote Loop-Free Alternate Fast Reroute

The following example shows how to enable remote LFA FRR:

```
Router(config)# router isis
Router(config)# fast-reroute per-prefix level-1 all
Router(config)# fast-reroute per-prefix level-2 all
Router(router-config)# fast-reroute remote-lfa level-1 mpls-ldp
Router(router-config)# fast-reroute remote-lfa level-2 mpls-ldp
```

Example: Configuring Remote LFA FRR with VPLS

Example: Configuration of Remote LFA FRR with Interior Gateway Protocol (IGP)

```
router isis hp
 net 49.0101.0000.0000.0802.00
 is-type level-2-only
 ispf level-2
 metric-style wide
 fast-flood
 set-overload-bit on-startup 180
 max-lsp-lifetime 65535
 lsp-refresh-interval 65000
 spf-interval 5 50 200
 prc-interval 5 50 200
 lsp-gen-interval 5 5 200
 no hello padding
 log-adjacency-changes
 nsf cisco
 fast-reroute per-prefix level-1 all
 fast-reroute per-prefix level-2 all
 fast-reroute remote-lfa level-1 mpls-ldp
 fast-reroute remote-lfa level-2 mpls-ldp
 passive-interface Loopback0
 mpls ldp sync
 mpls traffic-eng router-id Loopback0
 mpls traffic-eng level-2
```

Example: Configuration of Remote LFA FRR with VPLS at the interface level.

```
!
interface GigabitEthernet0/3/3
 ip address 198.51.100.1 255.255.255.0
 ip router isis hp
 logging event link-status
 load-interval 30
 negotiation auto
 mpls ip
 mpls traffic-eng tunnels
 isis network point-to-point
end
!
```

Example: Configuration of remote LFA FRR with VPLS at the global level.

```
!
l2 vfi Test-2000 manual
 vpn id 2010
 bridge-domain 2010
 neighbor 192.0.2.1 encapsulation mpls
!
```

Example: Configuration of remote LFA FRR with VPLS at Access side.

```
!
interface TenGigabitEthernet0/2/0
 no ip address
 service instance trunk 1 ethernet
  encapsulation dot1q 12-2012
  rewrite ingress tag pop 1 symmetric
```

```
 bridge-domain from-encapsulation
!
```

How to Configure OSPF IPv4 Remote Loop-Free Alternate IP Fast Reroute

Configuring a Remote LFA Tunnel

Perform this task to configure a per-prefix LFA FRR path that redirects traffic to a remote LFA tunnel.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router ospf** *process-id* **Example:** `Device(config)# router ospf 10`	Enables OSPF routing and enters router configuration mode.
Step 4	**fast-reroute per-prefix remote-lfa** [**area** *area-id*] **tunnel mpls-ldp** **Example:** `Device(config-router)# fast-reroute per-prefix remote-lfa area 2 tunnel mpls-ldp`	Configures a per-prefix LFA FRR path that redirects traffic to a remote LFA tunnel via MPLS-LDP. • Use the **area** *area-id* keyword and argument to specify an area in which to enable LFA FRR.

Recommended Configurations OSPF

For optimal results with remote LFA FRR, it is recommended that you use the following SFP timers:

- timers throttle spf 50 200 5000
- timers throttle lsa 50 200 5000
- timers lsa arrival 100
- timers pacing flood 33

Note ISPF should be disabled.

Configuring the Maximum Distance to a Tunnel Endpoint

Perform this task to configure the maximum distance to the tunnel endpoint in a per-prefix LFA FRR path that redirects traffic to a remote LFA tunnel.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router ospf** *process-id* **Example:** `Device(config)# router ospf 10`	Enables OSPF routing and enters router configuration mode.
Step 4	**fast-reroute per-prefix remote-lfa** [**area** *area-id*] **maximum-cost** *distance* **Example:** `Device(config-router)# fast-reroute per-prefix remote-lfa area 2 maximum-cost 30`	Configures the maximum distance to the tunnel endpoint in a per-prefix LFA FRR path that redirects traffic to a remote LFA tunnel. • Use the **area** *area-id* keyword and variable to specify an area in which to enable LFA FRR.

Configuring Remote LFA FRR for MLDP

Perform this task to configure the LDP based Remote LFA FRR for MLDP.

Note Ensure to configure a carrier delay down of 1 second on all core interfaces.

You must configure the **mpls mldp forwarding recursive** command to enable recursive forwarding. Do not disable this command while configuring Remote LFA MLDP.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. Enter your password if prompted.

	Command or Action	Purpose
	`Router enable`	
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**mpls ldp graceful-restart** **Example:** `Router(config)# mpls ldp graceful-restart`	Enables the router to protect the LDP bindings and MPLS forwarding state during a disruption in service.
Step 4	**mpls traffic-eng tunnels** **Example:** `Router(config)# mpls traffic-eng tunnels`	Enables MPLS traffic engineering tunnel signaling on a device.
Step 5	**mpls ldp discovery targeted-hello accept** **Example:** `Router(config)#mpls ldp discovery targeted-hello accept`	Enables MPLS LDP targeted discovery on a device.
Step 6	**mpls mldp make-before-break delay 1000** **Example:** `Router(config)#mpls mldp make-before-break delay 1000`	Enables MPLS MLDP MBB on a device.
Step 7	**end** **Example:** `Router(config)# end`	Exits router configuration mode and enters privileged EXEC mode.

Configuring IGP based Remote LFA for MLDP

Perform this task to configure the IGP based Remote LFA MLDP.

Procedure

	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 ospf***process-id* **Example:** `Router(config-router)# router ospf 10`	Enables OSPF routing and enters router configuration mode.
Step 4	**microloop avoidance rib-update-delay** *delay-time* **Example:** `Router(config-router)# microloop avoidance rib-update-delay 60000`	Specifies the amount of time the node uses the microloop avoidance policy before updating its forwarding table. The delay-time is in milliseconds. The range is from 1-60000.
Step 5	**fast-reroute per-prefix enable prefix-priority** *priority-level* **Example:** `Router(config-router)# fast-reroute per-prefix enable prefix-priority low`	Enables repair-path computation and selects the priority level for repair paths. Low priority specifies that all prefixes have the same eligibility for protection. High priority specifies that only high-priority prefixes are protected.
Step 6	**fast-reroute per-prefix remote-lfa**[**area** *area-id*] **tunnel mpls-ldp** **Example:** `Router(config-router)# fast-reroute per-prefix remote-lfa area 0 tunnel mpls-ldp`	Configures a per-prefix LFA FRR path that redirects traffic to a remote LFA tunnel via MPLS-LDP. Use the **area** area-id keyword and argument to specify an area in which to enable LFA FRR.
Step 7	**fast-reroute keep-all-paths** **Example:** `Router(config-router)# fast-reroute keep-all-paths`	Specifies creating a list of repair paths considered for LFA FRR.
Step 8	**end** **Example:** `Router(config)# end`	Exits router configuration mode and enters privileged EXEC mode.

Verifying Remote LFA for MLDP

Note The prefix 3.3.3.3 is mLDP Next Hop (NH) in the direction of receiver.

```
Router#show ip cef 3.3.3.3 internal
3.3.3.3/32, epoch 2, RIB[I], refcnt 9, per-destination sharing
  sources: RIB, RR, LTE
  feature space:
    IPRM: 0x00028000
    Broker: linked, distributed at 1st priority
    LFD: 3.3.3.3/32 1 local label
    dflt local label info: global/16 [0x3]
        contains path extension list
```

```
        dflt disposition chain 0x37D08728
          label implicit-null
          FRR Primary
            <primary: IP adj out of GigabitEthernet0/0/5, addr 10.1.1.2>
        dflt label switch chain 0x37D08488
          label implicit-null
          FRR Primary
            <primary: TAG adj out of GigabitEthernet0/0/5, addr 10.1.1.2>
  subblocks:
    3 RR sources [no flags]
      non-eos chain [implicit-null|17](ptr:0x37D08488)-(local:16)
  ifnums:
    GigabitEthernet0/0/5(12): 10.1.1.2
    MPLS-Remote-Lfa2(47)
  path list 3711ACA0, 3 locks, per-destination, flags 0x49 [shble, rif, hwcn]
    path 2A05F610, share 1/1, type attached nexthop, for IPv4, flags [has-rpr]
      MPLS short path extensions: [none] MOI flags = 0x21 label implicit-null
      nexthop 10.1.1.2 GigabitEthernet0/0/5 label
[implicit-null|17](ptr:0x37D08728)-(local:16), IP adj out of GigabitEthernet0/0/5, addr
10.1.1.2 379E4940
        repair: attached-nexthop 5.5.5.5 MPLS-Remote-Lfa2 (2A05F2E0)
    path 2A05F2E0, share 1/1, type attached nexthop, for IPv4, flags [rpr, rpr-only]
     nexthop 5.5.5.5 MPLS-Remote-Lfa2, repair, IP midchain out of MPLS-Remote-Lfa2 379E5740

  output chain:
    label [implicit-null|17](ptr:0x37D08728)-(local:16)
    FRR Primary (0x36EE6520)
      <primary: IP adj out of GigabitEthernet0/0/5, addr 10.1.1.2 379E4940>
      <repair:  TAG midchain out of MPLS-Remote-Lfa2 379E7340
                label 25-(local:24)
                TAG adj out of GigabitEthernet0/1/7, addr 60.1.1.2 379E4F40>
```

The following is sample output from the **show ip mfib vrf** command:

```
Router3#show ip mfib vrf vrf1 232.0.0.1
Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A flag,
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
                ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
                MS  - MoFRR  Entry in Sync, MC - MoFRR entry in MoFRR Client,
                e   - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                MA - MFIB Accept, A2 - Accept backup,
                RA2 - MRIB Accept backup, MA2 - MFIB Accept backup

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
VRF vrf1
 (100.1.1.2,232.0.0.1) Flags: HW
   SW Forwarding: 0/0/0/0, Other: 0/0/0
   HW Forwarding:   6106/1/100/1, Other: 0/0/0
   GigabitEthernet0/1/0 Flags: A
   Lspvif2, LSM/6, RPF-ID: *, Flags: F
     Pkts: 0/0/0    Rate: 0 pps
```

The following is sample output from the **show adjacency lspvif 2 internal** command:

```
Router#show adjacency Lspvif2 internal
Protocol Interface                 Address
IP       Lspvif2                   225.0.0.0(2) (incomplete)
                                   0 packets, 0 bytes
```

```
                                    epoch 0
                                    sourced in sev-epoch 80
                                    punt (rate-limited) packets
                                    no src set
                                    L3 mtu 1500
                                    Flags (0x882)
                                    Fixup disabled
                                    HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                    IP redirect disabled
                                    Switching vector: IPv4 incomplete adj oce
                                    IPv4 MFIB wire 0x3653E020
                                    LSM-ID: 0x0
                                    Platform adj-id: 0xF8000311, 0x0, tun_qos_dpidx:0

                                    Adjacency pointer 0x379E4740
                                    Next-hop 225.0.0.0
IP       Lspvif2                    225.0.0.0(4)
                                    connectionid 6
                                    0 packets, 0 bytes
                                    epoch 0
                                    sourced in sev-epoch 80
                                    empty encap string
                                    Multicast
                                    Next chain element:
                                      replicate
                                        0: label 28
                                        label [implicit-null|17](ptr:0x37D08488)-(local:16)

                                           FRR Primary (0x31EF4540)
                                             <primary: TAG adj out of GigabitEthernet0/0/5,
 addr 10.1.1.2 379E5140>
                                             <repair:  TAG midchain out of MPLS-Remote-Lfa2
 379E7340
                                                       label 25-(local:24)
                                                       TAG adj out of GigabitEthernet0/1/7,
 addr 60.1.1.2 379E4F40>
                                      parent oce 0x37971348
                                    L3 mtu 1500
                                    Flags (0x8C6)
                                    Fixup disabled
                                    HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                    IP redirect disabled
                                    Switching vector: IPv4 midchain adj oce
                                    IPv4 MFIB wire 0x392A003C
                                    LSM-ID: 0x6
                                    MPLS subblock: flags 0x18 NSF PATH_SET
                                      Path Set Id 0x00000006   Num Paths 1   Owner MLDP
Flags 0xD   RefCount 3
                                        path recursive 3.3.3.3  label 28  MOI flags 0x1
                                        EOS output chain elements: replicate
                                          0: label 28
                                             label
[implicit-null|17](ptr:0x37D08488)-(local:16)
                                             FRR Primary (0x31EF4540)
                                             <primary: TAG adj out of GigabitEthernet0/0/5,
 addr 10.1.1.2 379E5140>
                                             <repair:  TAG midchain out of MPLS-Remote-Lfa2
 379E7340
                                                       label 25-(local:24)
                                                     TAG adj out of GigabitEthernet0/1/7,
 addr 60.1.1.2 379E4F40>
                                        NonEOS output chain elements: replicate
                                          0: label 28
                                             label
```

```
[implicit-null|17](ptr:0x37D08488)-(local:16)
                                          FRR Primary (0x31EF4540)
                                          <primary: TAG adj out of GigabitEthernet0/0/5,
 addr 10.1.1.2 379E5140>
                                          <repair:  TAG midchain out of MPLS-Remote-Lfa2
 379E7340
                                                    label 25-(local:24)
                                                  TAG adj out of GigabitEthernet0/1/7,
 addr 60.1.1.2 379E4F40>
                                     oce chain (0x37971348):
                                       replicate
                                         0: label 28
                                            label
[implicit-null|17](ptr:0x37D08488)-(local:16)
                                           FRR Primary (0x31EF4540)
                                          <primary: TAG adj out of GigabitEthernet0/0/5,
 addr 10.1.1.2 379E5140>
                                          <repair:  TAG midchain out of MPLS-Remote-Lfa2
 379E7340
                                              label 25-(local:24)
                                          TAG adj out of GigabitEthernet0/1/7,
 addr 60.1.1.2 379E4F40>
                                    adj-sb send-slotmask: 0x0
                                   Platform adj-id: 0x10EC, 0x0, tun_qos_dpidx:0

                                   Adjacency pointer 0x379E4540
                                   Next-hop 225.0.0.0
IP       Lspvif2                   227.0.0.0(3)
                                   connectionid 1
                                   0 packets, 0 bytes
                                   epoch 0
                                   sourced in sev-epoch 80
                                   empty encap string
                                   Inject p2mp Multicast
                                   L3 mtu 17940
                                     mtu update from interface suppressed
                                   Flags (0x8A6)
                                   Fixup disabled
                                   HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                   IP redirect disabled
                                   Switching vector: IPv4 no fixup adj oce
                                   LSM-ID: 0x1
                                   Platform adj-id: 0xF8000314, 0x0, tun_qos_dpidx:0

                                   Adjacency pointer 0x379E7540
                                   Next-hop 227.0.0.0
IPV6     Lspvif2                   FF0E::(2) (incomplete)
                                   0 packets, 0 bytes
                                   epoch 0
                                   sourced in sev-epoch 80
                                   punt (rate-limited) packets
                                   no src set
                                   L3 mtu 1500
                                   Flags (0x1882)
                                   Fixup disabled
                                   HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                   IP redirect enabled
                                   Switching vector: IPv6 adjacency oce
                                   IPv6 MFIB wire 0x3653E054
                                   LSM-ID: 0x0
                                   Platform adj-id: 0xF8000312, 0x0, tun_qos_dpidx:0

                                   Adjacency pointer 0x379E5940
                                   Next-hop FF0E::
```

```
IPV6     Lspvif2                 FF0E::(3)
                                 connectionid 5
                                 0 packets, 0 bytes
                                 epoch 0
                                 sourced in sev-epoch 80
                                 empty encap string
                                 Multicast
                                 Next chain element:
                                   label ipv6-explicit-null
                                   TAG midchain out of Lspvif2, addr FF0E::, cid: 5
379E5D40
                                   replicate
                                   parent oce 0x3791B5B0
                                 L3 mtu 1500
                                 Flags (0x18C6)
                                 Fixup disabled
                                 HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                 IP redirect enabled
                                 Switching vector: IPv6 midchain adjacency oce
                                 LSM-ID: 0x5
                                 MPLS subblock: flags 0x8 NSF
                                   Lspvif2 FF0E:: label ipv6-explicit-null
                                     oce chain (0x3791B5B0):
                                       label ipv6-explicit-null
                                       TAG midchain out of Lspvif2, addr FF0E::, cid: 5
379E5D40
                                       replicate
                                   adj-sb send-slotmask: 0x0
                                 Platform adj-id: 0x10DD, 0x0, tun_qos_dpidx:0

                                 Adjacency pointer 0x379E5F40
                                 Next-hop FF0E::
TAG      Lspvif2                 FF0E::(4)
                                 connectionid 5
                                 0 packets, 0 bytes
                                 epoch 0
                                 sourced in sev-epoch 80
                                 empty encap string
                                 Multicast
                                 Next chain element:
                                   replicate
                                   parent oce 0x37970E50
                                 L3 mtu 17940
                                 Flags (0x8C6)
                                 Fixup disabled
                                 HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                 IP redirect disabled
                                 Switching vector: MPLS midchain adjacency oce
                                 LSM-ID: 0x5
                                 MPLS subblock: flags 0x18 NSF PATH_SET
                                   Path Set Id 0x00000005   Num Paths 0   Owner MLDP
Flags 0xD   RefCount 3
                                     EOS output chain elements: replicate
                                     NonEOS output chain elements: replicate
                                     oce chain (0x37970E50):
                                       replicate
                                   adj-sb send-slotmask: 0x0
                                 Platform adj-id: 0x10DE, 0x0, tun_qos_dpidx:0

                                 Adjacency pointer 0x379E5D40
                                 Next-hop FF0E::
IPV6     Lspvif2                 FFFF::(3)
                                 connectionid 1
                                 0 packets, 0 bytes
```

```
                                    epoch 0
                                    sourced in sev-epoch 80
                                    empty encap string
                                    Inject p2mp Multicast
                                    L3 mtu 1500
                                    Flags (0x1886)
                                    Fixup disabled
                                    HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                    IP redirect enabled
                                    Switching vector: IPv6 adjacency oce
                                    LSM-ID: 0x1
                                    Platform adj-id: 0xF8000315, 0x0, tun_qos_dpidx:0

                                    Adjacency pointer 0x379E7940
                                    Next-hop FFFF::
TAG      Lspvif2                    FFFF::(3)
                                    connectionid 1
                                    0 packets, 0 bytes
                                    epoch 0
                                    sourced in sev-epoch 80
                                    empty encap string
                                    Inject p2mp Multicast
                                    L3 mtu 17940
                                    Flags (0x886)
                                    Fixup disabled
                                    HWIDB/IDB pointers 0x3831A6DC/0x3929EAA0
                                    IP redirect disabled
                                    Switching vector: MPLS adjacency oce
                                    LSM-ID: 0x1
                                    Platform adj-id: 0x10DA, 0x0, tun_qos_dpidx:0

                                    Adjacency pointer 0x379E5B40
                                    Next-hop FFFF::
Router#
```

Verifying Loop-Free Alternate Fast Reroute

Use one or more of the following commands to verify the LFA FRR configuration

- **show ip cef network-prefix internal**
- **show mpls infrastructure lfd pseudowire internal**
- **show platform hardware pp active feature cef database ipv4 network-prefix**

Example: Verifying LFA FRR with L2VPN

show ip cef internal

The following is sample output from the **show ip cef internal** command:

```
Device# show ip cef 16.16.16.16 internal
16.16.16.16/32, epoch 2, RIB[I], refcount 7, per-destination sharing
  sources: RIB, RR, LTE
  feature space:
   IPRM: 0x00028000
   Broker: linked, distributed at 1st priority
   LFD: 16.16.16.16/32 1 local label
```

```
   local label info: global/17
        contains path extension list
        disposition chain 0x3A3C1DF0
        label switch chain 0x3A3C1DF0
  subblocks:
   1 RR source [no flags]
    non-eos chain [16|44]
  ifnums:
   GigabitEthernet0/0/2(9): 7.7.7.2
   GigabitEthernet0/0/7(14): 7.7.17.9
  path 35D61070, path list 3A388FA8, share 1/1, type attached nexthop, for IPv4, flags
has-repair
    MPLS short path extensions: MOI flags = 0x20 label 16
  nexthop 7.7.7.2 GigabitEthernet0/0/2 label [16|44], adjacency IP adj out of
GigabitEthernet0/0/2, addr 7.7.7.2 35E88520
    repair: attached-nexthop 7.7.17.9 GigabitEthernet0/0/7 (35D610E0)
  path 35D610E0, path list 3A388FA8, share 1/1, type attached nexthop, for IPv4, flags
repair, repair-only
  nexthop 7.7.17.9 GigabitEthernet0/0/7, repair, adjacency IP adj out of GigabitEthernet0/0/7,
 addr 7.7.17.9 3A48A4E0
  output chain: label [16|44]
  FRR Primary (0x35D10F60)
  <primary:  TAG adj out of GigabitEthernet0/0/2, addr 7.7.7.2 35E88380>
  <repair:  TAG adj out of GigabitEthernet0/0/7, addr 7.7.17.9 3A48A340>
Rudy17#show mpls infrastructure lfd pseudowire internal
PW ID: 1VC ID: 4, Nexthop address: 16.16.16.16
SSM Class: SSS HW
Segment Count: 1
VCCV Types Supported:  cw ra ttl
Imposition details:
 Label stack {22 16}, Output interface: Gi0/0/2
 Preferred path: not configured
 Control Word: enabled, Sequencing: disabled
 FIB Non IP entry: 0x35D6CEEC
 Output chain:  AToM Imp (locks 4) label 22 label [16|44]
  FRR Primary (0x35D10F60)
  <primary:  TAG adj out of GigabitEthernet0/0/2, addr 7.7.7.2 35E88380>
Disposition details:
 Local label: 16
 Control Word: enabled, Sequencing: disabled
 SSS Switch: 3976200193
 Output chain:  mpls_eos( connid router-alert AToM Disp (locks 5)/ drop)
```

show mpls infrastructure lfd pseudowire internal

The following is sample output from the **show mpls infrastructure lfd pseudowire internal** command:

```
Device# show mpls infrastructure lfd pseudowire internal
PW ID: 1VC ID: 4, Nexthop address: 16.16.16.16
SSM Class: SSS HW
Segment Count: 1
VCCV Types Supported:  cw ra ttl
Imposition details:
 Label stack {22 16}, Output interface: Gi0/0/2
 Preferred path: not configured
 Control Word: enabled, Sequencing: disabled
 FIB Non IP entry: 0x35D6CEEC
 Output chain:  AToM Imp (locks 4) label 22 label [16|44]
  FRR Primary (0x35D10F60)
  <primary:  TAG adj out of GigabitEthernet0/0/2, addr 7.7.7.2 35E88380>
Disposition details:
```

```
 Local label: 16
 Control Word: enabled, Sequencing: disabled
 SSS Switch: 3976200193
 Output chain:  mpls_eos( connid router-alert AToM Disp (locks 5)/ drop)
```

show platform hardware pp active feature cef database

The following is sample output from the **show platform hardware pp active feature cef database** command:

```
Device# show platform hardware pp active feature cef database ipv4 16.16.16.16/32
=== CEF Prefix ===
16.16.16.16/32 -- next hop: UEA Label OCE (PI:0x104abee0, PD:0x10e6b9c8)
                Route Flags: (0)
                Handles (PI:0x104ab6e0) (PD:0x10e68140)

  HW Info:
    TCAM handle: 0x0000023f    TCAM index: 0x0000000d
    FID index  : 0x0000f804    EAID      : 0x0000808a
    MET        : 0x0000400c    FID Count : 0x00000000

=== Label OCE ===
  Label flags: 4
  Num Labels: 1
  Num Bk Labels: 1
  Out Labels: 16
  Out Backup Labels: 44
  Next OCE Type: Fast ReRoute OCE; Next OCE handle: 0x10e6f428

=== FRR OCE ===
  FRR type         : IP FRR
  FRR state        : Primary
  Primary IF's gid : 3
  Primary FID      : 0x0000f801
  FIFC entries     : 32
  PPO handle       : 0x00000000
  Next OCE         : Adjacency (0x10e63b38)
  Bkup OCE         : Adjacency (0x10e6e590)

=== Adjacency OCE ===
  Adj State: COMPLETE(0)   Address: 7.7.7.2
  Interface: GigabitEthernet0/0/2   Protocol: TAG
  mtu:1500, flags:0x0, fixups:0x0, encap_len:14
  Handles (adj_id:0x00000039) (PI:0x1041d410) (PD:0x10e63b38)
  Rewrite Str: d0:c2:82:17:8a:82:d0:c2:82:17:f2:02:88:47

  HW Info:
    FID index: 0x0000f486    EL3 index: 0x00001003    EL2 index: 0x00000000
    El2RW    : 0x00000107    MET index: 0x0000400c    EAID     : 0x00008060
    HW ADJ FLAGS: 0x40
    Hardware MAC Rewrite Str: d0:c2:82:17:8a:82:08:00:40:00:0d:02

=== Adjacency OCE ===
  Adj State: COMPLETE(0)   Address: 7.7.17.9
  Interface: GigabitEthernet0/0/7   Protocol: TAG
  mtu:1500, flags:0x0, fixups:0x0, encap_len:14
  Handles (adj_id:0x00000012) (PI:0x104acbd0) (PD:0x10e6e590)
  Rewrite Str: d0:c2:82:17:c9:83:d0:c2:82:17:f2:07:88:47

  HW Info:
    FID index: 0x0000f49d    EL3 index: 0x00001008    EL2 index: 0x00000000
    El2RW    : 0x00000111    MET index: 0x00004017    EAID     : 0x0000807d
```

```
HW ADJ FLAGS: 0x40
Hardware MAC Rewrite Str: d0:c2:82:17:c9:83:08:00:40:00:0d:07
```

Configuration Examples for OSPF IPv4 Remote Loop-Free Alternate IP Fast Reroute

Example: Configuring a Remote LFA Tunnel

The following example shows how to configure a remote per-prefix LFA FRR in area 2. The remote tunnel type is specified as MPLS-LDP:

```
Router(config-router)# fast-reroute per-prefix remote-lfa area 2 tunnel mpls-ldp
```

Example: Configuring the Maximum Distance to a Tunnel Endpoint

The following example shows how to set a maximum cost of 30 in area 2:

```
Router(config-router)# fast-reroute per-prefix remote-lfa area 2 maximum-cost 30
```

Example: Verifying Tunnel Interfaces Created by OSPF IPv4 Remote LFA IPFRR

The following example displays information about about tunnel interfaces created by OSPF IPv4 LFA IPFRR:

```
Router# show ip ospf fast-reroute remote-lfa tunnels

      OSPF Router with ID (192.168.1.1) (Process ID 1)
      Area with ID (0)
      Base Topology (MTID 0)

Interface MPLS-Remote-Lfa3
 Tunnel type: MPLS-LDP
 Tailend router ID: 192.168.3.3
 Termination IP address: 192.168.3.3
 Outgoing interface: Ethernet0/0
 First hop gateway: 192.168.14.4
 Tunnel metric: 20
 Protects:
  192.168.12.2 Ethernet0/1, total metric 30
```

Verifying Remote Loop-Free Alternate Fast Reroute with VPLS

Example: Verifying Remote LFA FRR with VPLS

show ip cef internal

The following is sample output from the **show ip cef internal** command:

```
Router# show ip cef 198.51.100.2/32 internal

198.51.100.2/32, epoch 2, RIB[I], refcount 7, per-destination sharing
  sources: RIB, RR, LTE
  feature space:
   IPRM: 0x00028000
   Broker: linked, distributed at 1st priority
   LFD: 198.51.100.2/32 1 local label
   local label info: global/2033
        contains path extension list
        disposition chain 0x46764E68
        label switch chain 0x46764E68
  subblocks:
   1 RR source [heavily shared]
    non-eos chain [explicit-null|70]
  ifnums:
   TenGigabitEthernet0/1/0(15): 192.0.2.10
   MPLS-Remote-Lfa2(46)
  path 44CE1290, path list 433CF8C0, share 1/1, type attached nexthop, for IPv4, flags
has-repair
    MPLS short path extensions: MOI flags = 0x21 label explicit-null
  nexthop 192.0.2.10 TenGigabitEthernet0/1/0 label [explicit-null|70], adjacency IP adj out
 of TenGigabitEthernet0/1/0, addr 192.0.2.10 404B3960
    repair: attached-nexthop 192.0.2.1 MPLS-Remote-Lfa2 (44CE1300)
  path 44CE1300, path list 433CF8C0, share 1/1, type attached nexthop, for IPv4, flags
repair, repair-only
  nexthop 192.0.2.1 MPLS-Remote-Lfa2, repair, adjacency IP midchain out of MPLS-Remote-Lfa2
 404B3B00
  output chain: label [explicit-null|70]
  FRR Primary (0x3E25CA00)
  <primary:  TAG adj out of TenGigabitEthernet0/1/0, addr 192.168.101.22 404B3CA0>
  <repair:  TAG midchain out of MPLS-Remote-Lfa2 404B37C0 label 37 TAG adj out of
GigabitEthernet0/3/3, addr 192.0.2.14 461B2F20>
```

show ip cef detail

The following is sample output from the **show ip cef detail** command:

```
Router# show ip cef 198.51.100.2/32 detail

198.51.100.2/32, epoch 2
  local label info: global/2033
  1 RR source [heavily shared]
  nexthop 192.0.2.14 TenGigabitEthernet0/1/0 label [explicit-null|70]
    repair: attached-nexthop 192.0.2.1 MPLS-Remote-Lfa2
  nexthop 192.0.2.1 MPLS-Remote-Lfa2, repair
!
```

show platform hardware pp active feature cef databas

The following is sample output from the **show platform hardware pp active feature cef database** command:

```
Router# show platform hardware pp active feature cef database ipv4 198.51.100.2/32

=== CEF Prefix ===
198.51.100.2/32 -- next hop: UEA Label OCE (PI:0x10936770, PD:0x12dd1cd8)
                Route Flags: (0)
                Handles (PI:0x109099c8) (PD:0x12945968)

  HW Info:
    TCAM handle: 0x00000266    TCAM index: 0x00000015
    FID index  : 0x00008e7f    EAID      : 0x0001d7c4
    MET        : 0x0000401c    FID Count : 0x00000000
=== Label OCE ===
  Label flags: 4
  Num Labels: 1
  Num Bk Labels: 1
  Out Labels: 0
  Out Backup Labels: 70
=== FRR OCE ===
  FRR type         : IP FRR
  FRR state        : Primary
  Primary IF's gid : 52
  Primary FID      : 0x00008cb6
  FIFC entries     : 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0
  PPO handle       : 0x00000000
  Next OCE         : Adjacency (0x130e0df0)
  Bkup OCE         : Adjacency (0x130de608)

=== Adjacency OCE ===
  Adj State: COMPLETE(0)   Address: 192.168.101.22
  Interface: TenGigabitEthernet0/1/0   Protocol: TAG
  mtu:1500, flags:0x0, fixups:0x0, encap_len:14
  Handles (adj_id:0x000016ac) (PI:0x1090cc10) (PD:0x130e0df0)
  Rewrite Str: 18:33:9d:3d:83:10:c8:f9:f9:8d:04:10:88:47
HW Info:
    FID index: 0x00008e7e    EL3 index: 0x00001034    EL2 index: 0x00000000
    El2RW    : 0x0000010d    MET index: 0x00004012    EAID     : 0x0001d7c1
    HW ADJ FLAGS: 0x40
    Hardware MAC Rewrite Str: 18:33:9d:3d:83:10:08:00:40:00:0d:10
=== Adjacency OCE ===
  Adj State: COMPLETE(0)   Address: 0
  Interface: MPLS-Remote-Lfa2   Protocol: TAG
  mtu:17940, flags:0x40, fixups:0x0, encap_len:0
  Handles (adj_id:0xf80002e8) (PI:0x10da2150) (PD:0x130de608)
  Rewrite Str:

  HW Info:
    FID index: 0x00008ca8    EL3 index: 0x0000101c    EL2 index: 0x00000000
    El2RW    : 0x00000003    MET index: 0x00004024    EAID     : 0x0001d7cb
    HW ADJ FLAGS: 0x40
    Hardware MAC Rewrite Str: 00:00:00:00:00:00:00:00:00:00:00:00

=== Label OCE ===
  Label flags: 4
  Num Labels: 1
Num Bk Labels: 1
  Out Labels: 37
  Out Backup Labels: 37
```

```
  Next OCE Type: Adjacency; Next OCE handle: 0x12943a00
=== Adjacency OCE ===
  Adj State: COMPLETE(0)   Address: 30.1.1.1
  Interface: GigabitEthernet0/3/3   Protocol: TAG
  mtu:1500, flags:0x0, fixups:0x0, encap_len:14
  Handles (adj_id:0x0000378e) (PI:0x10909738) (PD:0x12943a00)
  Rewrite Str: c8:f9:f9:8d:01:b3:c8:f9:f9:8d:04:33:88:47

  HW Info:
    FID index: 0x00008c78    EL3 index: 0x0000101c    EL2 index: 0x00000000
    El2RW    : 0x00000109    MET index: 0x0000400e    EAID     : 0x0001cf4b
    HW ADJ FLAGS: 0x40
    Hardware MAC Rewrite Str: c8:f9:f9:8d:01:b3:08:00:40:00:0d:33
```

show mpls l2transport detail

The following is sample output from the **show mpls l2transport detail** command:

```
Router# show mpls l2transport vc 2000 detail

Local interface: VFI Test-1990 vfi up
  Interworking type is Ethernet
  Destination address: 192.0.2.1, VC ID: 2000, VC status: up
    Output interface: Te0/1/0, imposed label stack {0 2217}
    Preferred path: not configured
    Default path: active
    Next hop: 192.51.100.22
  Create time: 1d08h, last status change time: 1d08h
    Last label FSM state change time: 1d08h
  Signaling protocol: LDP, peer 192.0.51.1:0 up
    Targeted Hello: 192.51.100.2(LDP Id) -> 192.51.100.200, LDP is UP
    Graceful restart: configured and enabled
    Non stop routing: not configured and not enabled
    Status TLV support (local/remote)   : enabled/supported
      LDP route watch                   : enabled
      Label/status state machine        : established, LruRru
      Last local dataplane   status rcvd: No fault
      Last BFD dataplane     status rcvd: Not sent
      Last BFD peer monitor  status rcvd: No fault
      Last local AC  circuit status rcvd: No fault
      Last local AC  circuit status sent: No fault
      Last local PW i/f circ status rcvd: No fault
      Last local LDP TLV     status sent: No fault
      Last remote LDP TLV    status rcvd: No fault
```

Verifying Tunnel Interfaces Created by OSPF IPv4 Remote LFA IPFRR

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
	`Device> enable`	
Step 2	**show ip ospf fast-reroute remote-lfa tunnels** **Example:** `Device# show ip ospf fast-reroute remote-lfa tunnels`	Displays information about the OSPF per-prefix LFA FRR configuration.

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
MPLS commands	Multiprotocol Label Switching Command Reference

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