The MPLS Multilink PPP Support feature ensures that MPLS Layer 3 Virtual Private Networks (VPNs) with quality of service (QoS) can be enabled for bundled links. This feature supports Multiprotocol Label Switching (MPLS) over Multilink PPP (MLP) links in the edge (provider edge [PE]-to-customer edge [CE]) or in the MPLS core (PE-to-PE and PE-to-provider [P] device).

Service providers that use relatively low-speed links can use MLP to spread traffic across them in their MPLS networks. Link fragmentation and interleaving (LFI) should be deployed in the CE-to-PE link for efficiency, where traffic uses a lower link bandwidth (less than 768 kbps). The MPLS Multilink PPP Support feature can reduce the number of Interior Gateway Protocol (IGP) adjacencies and facilitate load sharing of traffic.

- Prerequisites for MPLS Multilink PPP Support, on page 1
- Restrictions for MPLS Multilink PPP Support, on page 1
- Information About MPLS Multilink PPP Support, on page 2
- How to Configure MPLS Multilink PPP Support, on page 6
- Configuration Examples for MPLS Multilink PPP Support, on page 14

Prerequisites for MPLS Multilink PPP Support

- Multiprotocol Label Switching (MPLS) must be enabled on provider edge (PE) and provider (P) devices

Restrictions for MPLS Multilink PPP Support

- Only 168 multilink bundles can be created per the OC-3 interface module on the router.
- The maximum number of members per multilink bundle is 16.
- Links in multilink bundles must be on the same interface module.
- On the 8 T1/E1, a maximum of 8 bundles can be supported.
- On the 16T1/E1, a maximum of 16 bundles can be supported.
On the 32 T1/E1, a maximum of 32 bundles can be supported.

For information on how to configure, Protocol-Field-Compression (PFC) and Address-and-Control-Field-Compression (AFC), see Configuring PPP and Multilink PPP on the Cisco ASR 903 Router.

**Information About MPLS Multilink PPP Support**

**MPLS Layer 3 Virtual Private Network Features Supported for Multilink PPP**

The table below lists Multiprotocol Label Switching (MPLS) Layer 3 Virtual Private Network (VPN) features supported for Multilink PPP (MLP) and indicates if the feature is supported on customer edge-to-provider edge (CE-to-PE) links, PE-to-provider (P) links, and Carrier Supporting Carrier (CSC) CE-to-PE links.

**Table 1: MPLS Layer 3 VPN Features Supported for MLP**

<table>
<thead>
<tr>
<th>MPLS L3 VPN Feature</th>
<th>CE-to-PE Links</th>
<th>PE-to-P Links</th>
<th>CSC CE-to-PE Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static routes</td>
<td>Supported</td>
<td>Not supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>External Border Gateway Protocol (eBGP)</td>
<td>Supported</td>
<td>Not applicable to this configuration</td>
<td>Supported</td>
</tr>
<tr>
<td>Intermediate System-to-Intermediate System (IS-IS)</td>
<td>Not supported</td>
<td>Supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>Open Shortest Path First (OSPF)</td>
<td>Supported</td>
<td>Supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>Enhanced Interior Gateway Routing Protocol (EIGRP)</td>
<td>Supported</td>
<td>Supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>Interprovider interautonomous (Inter-AS) VPNI (with Label Distribution Protocol [LDP])</td>
<td>Not applicable to this configuration</td>
<td>Supported (MLP between Autonomous System Boundary Routers [ASBRs])</td>
<td>Not applicable to this configuration</td>
</tr>
<tr>
<td>Inter-AS VPNI with IPv4 Label Distribution</td>
<td>Not applicable to this configuration</td>
<td>Supported (MLP between ASBRs)</td>
<td>Not applicable to this configuration</td>
</tr>
<tr>
<td>CSC VPNI (with LDP)</td>
<td>Not supported</td>
<td>Not applicable to this configuration</td>
<td>Supported</td>
</tr>
<tr>
<td>CSC VPNI with IPv4 label distribution</td>
<td>Supported</td>
<td>Not applicable to this configuration</td>
<td>Supported</td>
</tr>
<tr>
<td>External and internal BGP (eiBGP) Multipath</td>
<td>Not supported</td>
<td>Not supported</td>
<td>Not applicable to this configuration</td>
</tr>
<tr>
<td>Internal BGP (iBGP) Multipath</td>
<td>Not applicable to this configuration</td>
<td>Not supported</td>
<td>Not applicable to this configuration</td>
</tr>
</tbody>
</table>
MPLS Quality of Service Features Supported for Multilink PPP

The table below lists the Multiprotocol Label Switching (MPLS) quality of service (QoS) features supported for Multilink PPP (MLP) and indicates if the feature is supported on customer edge-to-provider edge (CE-to-PE) links, PE-to-provider (P) links, and Carrier Supporting Carrier (CSC) CE-to-PE links.

**Table 2: MPLS QoS Features Supported for MLP**

<table>
<thead>
<tr>
<th>MPLS QoS Feature</th>
<th>CE-to-PE Links</th>
<th>PE-to-P Links</th>
<th>CSC CE-to-PE Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default copy of IP Precedence to EXP bits and the reverse</td>
<td>Supported</td>
<td>Not supported</td>
<td>Not supported</td>
</tr>
<tr>
<td>Set MPLS EXP bits using the modular QoS Command-Line Interface (MQC)</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Matching on MPLS EXP using MQC</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Low Latency Queueing (LLQ)/Class-Based Weighted Fair Queueing (CBWFQ) support</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Weighted Random Early Detection (WRED) based on EXP bits using MQC</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Policer with EXP bit-marking using MQC-3 action</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>Support for EXP bits in MPLS accounting</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>

MPLS Multilink PPP Support and PE-to-CE Links

The figure below shows a typical Multiprotocol Label Switching (MPLS) network in which the provider edge (PE) device is responsible for label imposition (at ingress) and disposition (at egress) of the MPLS traffic.

In this topology, Multilink PPP (MLP) is deployed on the PE-to-customer edge (CE) links. The Virtual Private Network (VPN) routing and forwarding instance (VRF) interface is in a multilink bundle. There is no MPLS interaction with MLP; all packets coming into the MLP bundle are IP packets.
The PE-to-CE routing protocols that are supported for the MPLS Multilink PPP Support feature are external Border Gateway Protocol (eBGP), Open Shortest Path First (OSPF), and Enhanced Interior Gateway Routing Protocol (EIGRP). Static routes are also supported between the CE and PE devices.

Quality of service (QoS) features that are supported for the MPLS Multilink PPP Support feature on CE-to-PE links are link fragmentation and interleaving (LFI), compressed Real-Time Transport Protocol (cRTP), policing, marking, and classification.

**MPLS Multilink PPP Support and Core Links**

The figure below shows a sample topology in which Multiprotocol Label Switching (MPLS) is deployed over Multilink PPP (MLP) on provider edge-to-provider (PE-to-P) and P-to-P links. Enabling MPLS on MLP for PE-to-P links is similar to enabling MPLS on MLP for P-to-P links.

You employ MLP in the PE-to-P or P-to-P links primarily so that you can reduce the number of Interior Gateway Protocol (IGP) adjacencies and facilitate the load sharing of traffic.
In addition to requiring MLP on the PE-to-P links, the MPLS Multilink PPP Support feature requires the configuration of an IGP routing protocol and the Label Distribution Protocol (LDP).

**MPLS Multilink PPP Support in a CSC Network**

The figure below shows a typical Multiprotocol Label Switching (MPLS) Virtual Private Network (VPN) Carrier Supporting Carrier (CSC) network where Multilink PPP (MLP) is configured on the CSC customer edge (CE)-to-provider edge (PE) links.

*Figure 3: MLP on CSC CE-to-PE Links with MPLS VPN Carrier Supporting Carrier*

The MPLS Multilink PPP Support feature supports MLP between CSC-CE and CSC-PE links with the Label Distribution Protocol (LDP) or with external Border Gateway Protocol (eBGP) IPv4 label distribution. This feature also supports link fragmentation and interleaving (LFI) for an MPLS VPN CSC configuration. The figure below shows all MLP links that this feature supports for CSC configurations.

*Figure 4: MLP Supported Links with MPLS VPN Carrier Supporting Carrier*
MPLS Multilink PPP Support in an Interautonomous System

The figure below shows a typical Multiprotocol Label Switching (MPLS) Virtual Private Network (VPN) interautonomous system (Inter-AS) network where Multilink PPP (MLP) is configured on the provider edge-to-customer edge (PE-to-CE) links.

Figure 5: MLP on ASBR-to-PE Links in an MPLS VPN Inter-AS Network

The MPLS Multilink PPP Support feature supports MLP between Autonomous System Boundary Router (ASBR) links for Inter-AS VPNs with Label Distribution Protocol (LDP) and with external Border Gateway Protocol (eBGP) IPv4 label distribution.

How to Configure MPLS Multilink PPP Support

The tasks in this section can be performed on customer edge-to-provider edge (CE-to-PE) links, PE-to-provider (P) links, P-to-P links, and Carrier Supporting Carrier (CSC) CE-to-PE links.

Creating a Multilink Bundle

Perform this task to create a multilink bundle for the MPLS Multilink PPP Support feature. This multilink bundle can reduce the number of Interior Gateway Protocol (IGP) adjacencies and facilitate load sharing of traffic.

SUMMARY STEPS

1. enable
2. configure terminal
3. interface multilink group-number
4. ip address address mask [secondary]
5. encapsulation encapsulation-type
6. ppp multilink
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> interface multilink <em>group-number</em></td>
<td>Creates a multilink bundle and enters multilink interface configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# interface multilink 1</td>
<td>• The <em>group-number</em> argument is the number of the multilink bundle (a nonzero number).</td>
</tr>
<tr>
<td><strong>Step 4</strong> ip address <em>address</em> <em>mask</em> [secondary]</td>
<td>Sets a primary or secondary IP address for an interface.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-if)# ip address 10.0.0.0 255.255.0.0</td>
<td>• The <em>address</em> argument is the IP address.</td>
</tr>
<tr>
<td></td>
<td>• The <em>mask</em> argument is the mask for the associated IP subnet.</td>
</tr>
<tr>
<td></td>
<td>• The <em>secondary</em> keyword specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.</td>
</tr>
<tr>
<td>This command is used to assign an IP address to the multilink interface.</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> encapsulation <em>encapsulation-type</em></td>
<td>Sets the encapsulation method as PPP to be used by the interface.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-if)# encapsulation ppp</td>
<td>• The <em>encapsulation-type</em> argument specifies the encapsulation type.</td>
</tr>
<tr>
<td><strong>Step 6</strong> ppp multilink</td>
<td>Enables MLP on an interface.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-if)# ppp multilink</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> mpls ip</td>
<td>Enables label switching on the interface.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-if)# mpls ip</td>
<td></td>
</tr>
</tbody>
</table>
Assigning an Interface to a Multilink Bundle

SUMMARY STEPS

1. enable
2. configure terminal
3. controller {t1 | e1} slot/port
4. channel-group channel-number timeslots fulltimeslots
5. exit
6. interface serial slot/subslot / port : channel-group
7. ip route-cache [cef | distributed]
8. no ip address
9. keepalive [period [retries]]
10. encapsulation encapsulation-type
11. ppp multi-link group group-number
12. ppp multi-link
13. ppp authentication chap
14. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> controller {t1</td>
<td>e1} slot/port</td>
</tr>
<tr>
<td>Example: Device# controller t1 0/0/1</td>
<td>• The t1 keyword indicates a T1 line card.</td>
</tr>
<tr>
<td></td>
<td>• The e1 keyword indicates an E1 line card.</td>
</tr>
<tr>
<td></td>
<td>• The slot/port arguments are the backplane slot number and port number on the interface. Refer to your</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>hardware installation manual for the specific slot numbers and port numbers.</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>channel-group channel-number timeslots fulltimeslots</td>
</tr>
<tr>
<td>Example:</td>
<td>Defines the time slots that belong to each T1 or E1 circuit.</td>
</tr>
<tr>
<td></td>
<td>• The channel-number argument is the channel-group number. When a T1 data line is configured, channel-group numbers can be values from 1 to 24. When an E1 data line is configured, channel-group numbers can be values from 1 to 31.</td>
</tr>
<tr>
<td></td>
<td>• The timeslots fulltimeslots keyword and argument specifies time slots. For a T1 controller, the time slot is 1-24. For an E1 controller the time slot is 1-31.</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>exit</td>
</tr>
<tr>
<td>Example:</td>
<td>Returns to global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Device(config-controller)# exit</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>interface serial slot/subslot /port : channel-group</td>
</tr>
<tr>
<td>Example:</td>
<td>Configures a serial interface for a Cisco 7500 series router with channelized T1 or E1 and enters interface configuration mode.</td>
</tr>
<tr>
<td></td>
<td>• The slot argument indicates the slot number. Refer to the appropriate hardware manual for slot and port information.</td>
</tr>
<tr>
<td></td>
<td>• The /port argument indicates the port number. Refer to the appropriate hardware manual for slot and port information.</td>
</tr>
<tr>
<td></td>
<td>• The :channel-group argument indicates the channel group number. Cisco 7500 series routers specify the channel group number in the range of 0 to 4 defined with the channel-group controller configuration command.</td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>ip route-cache [cef</td>
</tr>
<tr>
<td>Example:</td>
<td>Controls the use of switching methods for forwarding IP packets.</td>
</tr>
<tr>
<td></td>
<td>• The cef keyword enables Cisco Express Forwarding operation on an interface after Cisco Express Forwarding operation was disabled.</td>
</tr>
<tr>
<td></td>
<td>• The distributed keyword enables distributed switching on the interface.</td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td>no ip address</td>
</tr>
<tr>
<td>Example:</td>
<td>Removes any specified IP address.</td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device(config-if)# no ip address</td>
<td>Enables keepalive packets and specifies the number of times that the Cisco software tries to send keepalive packets without a response before bringing down the interface or before bringing the tunnel protocol down for a specific interface.</td>
</tr>
<tr>
<td><strong>Step 9</strong> keepalive [period [retries]]</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-if)# keepalive</td>
<td>Since the keepalive command without any arguments is the default, this line is not necessary. It would typically be followed by another command.</td>
</tr>
<tr>
<td></td>
<td>If you are using this command with a tunnel interface, the command specifies the number of times that the device continues to send keepalive packets without a response before bringing the tunnel interface protocol down.</td>
</tr>
<tr>
<td></td>
<td>• The <em>period</em> argument is an integer value, in seconds, greater than 0. The default is 10.</td>
</tr>
<tr>
<td></td>
<td>• The <em>retries</em> argument specifies the number of times that the device continues to send keepalive packets without a response before bringing the interface down.</td>
</tr>
<tr>
<td></td>
<td>Enter an integer value greater than 1 and less than 255. If you do not enter a value, the value that was previously set is used; if no value was specified previously, the default of 5 is used.</td>
</tr>
<tr>
<td></td>
<td>If you are using this command with a tunnel interface, the command specifies the number of times that the device continues to send keepalive packets without a response before bringing the tunnel interface protocol down.</td>
</tr>
<tr>
<td></td>
<td>Sets the encapsulation method used by the interface.</td>
</tr>
<tr>
<td><strong>Step 10</strong> encapsulation encapsulation-type</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-if)# encapsulation ppp</td>
<td>• The <em>encapsulation-type</em> argument specifies the encapsulation type. The example specifies PPP encapsulation.</td>
</tr>
<tr>
<td></td>
<td>Restricts a physical link to join only one designated multilink group interface.</td>
</tr>
<tr>
<td><strong>Step 11</strong> ppp multilink group group-number</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>• The <em>group-number</em> argument is the number of the multilink bundle (a nonzero number).</td>
</tr>
<tr>
<td>Device(config-if)# ppp multilink group 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enables MLP on the interface.</td>
</tr>
<tr>
<td><strong>Step 12</strong> ppp multilink</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>(Optional) Enables Challenge Handshake Authentication Protocol (CHAP) authentication on the serial interface.</td>
</tr>
<tr>
<td></td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Step 13</strong> ppp authentication chap</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-if)# ppp authentication chap</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 14</strong> end</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-if)# end</td>
<td></td>
</tr>
</tbody>
</table>
Verifying the Multilink PPP Configuration

**SUMMARY STEPS**

1. enable
2. show ip interface brief
3. show ppp multilink
4. show ppp multilink interface *interface-bundle*
5. show interface *type number*
6. show mpls forwarding-table
7. exit

**DETAILED STEPS**

**Step 1**

**enable**

Enables privileged EXEC mode. Enter your password if prompted.

*Example:*

```
Device> enable
Device#
```

**Step 2**

**show ip interface brief**

Verifies logical and physical Multilink PPP (MLP) interfaces.

*Example:*

```
Device# show ip interface brief

Locolrface IP-Address OK? Method Status Prot
GigabitEthernet1/0/0 10.3.62.106 YES NVRAM up up
GigabitEthernet0/0/1 unassigned YES NVRAM administratively down down
GigabitEthernet0/0/0 unassigned YES NVRAM administratively down down
GigabitEthernet0/0/1 unassigned YES NVRAM administratively down down
GigabitEthernet0/0/2 unassigned YES NVRAM administratively down down
GigabitEthernet0/1/0 unassigned YES NVRAM administratively down down
GigabitEthernet0/1/1 unassigned YES NVRAM administratively down down
GigabitEthernet0/1/2 unassigned YES NVRAM administratively down down
Serial0/1/0:1 unassigned YES NVRAM administratively down down
Serial0/1/0:2 unassigned YES NVRAM administratively down down
Serial0/1/1:1 unassigned YES NVRAM up up
Serial0/1/1:2 unassigned YES NVRAM up up
Serial0/1/3:1 unassigned YES NVRAM up up
Serial0/1/3:2 unassigned YES NVRAM up up
Multilink6 10.30.0.2 YES NVRAM up up
Multilink8 unassigned YES NVRAM administratively down down
Multilink10 10.34.0.2 YES NVRAM up up
Loopback0 10.0.0.1 YES NVRAM up up

```

**Step 3**

**show ppp multilink**

Verifies that you have created a multilink bundle.

*Example:*

```

```
Device# show ppp multilink

Multilink1, bundle name is group 1
Bundle is Distributed
0 lost fragments, 0 reordered, 0 unassigned, sequence 0x0/0x0 rcvd/sent
0 discarded, 0 lost received, 1/255 load
Member links: 4 active, 0 inactive (max no set, min not set)
Serial0/0/0/1
Serial0/0/0/2
Serial0/0/0/3
Serial0/0/0/4

Step 4 show ppp multilink interface interface-bundle
Displays information about a specific MLP interface.
Example:

Device# show ppp multilink interface multilink6

Multilink6, bundle name is router
Bundle up for 00:42:46, 1/255 load
Receive buffer limit 24384 bytes, frag timeout 1524 ms
Bundle is Distributed
0/0 fragments/bytes in reassembly list
1 lost fragments, 48 reordered
0/0 discarded fragments/bytes, 0 lost received
0x4D7 received sequence, 0x0 sent sequence
Member links: 2 active, 0 inactive (max not set, min not set)
Se0/1/3:1, since 00:42:46, 240 weight, 232 frag size
Se0/1/3:2, since 00:42:46, 240 weight, 232 frag size

Step 5 show interface type number
Displays information about serial interfaces in your configuration.
Example:

Device# show interface serial 0/1/3:1

Serial0/1/3:1 is up, line protocol is up
Hardware is Multichannel T1
MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, LCP Open, multilink Open, crc 16, Data non-inverted
Last input 00:00:01, output 00:00:01, output hang never
Last clearing of "show interface" counters 00:47:13
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
722 packets input, 54323 bytes, 0 no buffer
    Received 0 broadcasts, 0 runs, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
697 packets output, 51888 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
1 carrier transitions no alarm present
Timeslot(s) Used:1, subrate: 64Kb/s, transmit delay is 0 flags
Transmit queue length 25
Device# show interface serial 0/1/3:2

Serial0/1/3:2 is up, line protocol is up
Hardware is Multichannel T1
MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, LCP Open, multilink Open, crc 16, Data non-inverted
Last input 00:00:03, output 00:00:03, output hang never
Last clearing of "show interface" counters 00:47:16
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
725 packets input, 54618 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  693 packets output, 53180 bytes, 0 underruns
  0 output errors, 0 collisions, 1 interface resets
  0 output buffer failures, 0 output buffers swapped out
  1 carrier transitions no alarm present
Timeslot(s) Used:2, subrate: 64Kb/s, transmit delay is 0 flags
Transmit queue length 26

You can also use the show interface command to display information about the multilink interface:

Example:

Device# show interface multilink6

Multilink6 is up, line protocol is up
Hardware is multilink group interface
Internet address is 10.30.0.2/8
MTU 1500 bytes, BW 128 Kbit, DLY 100000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, LCP Open, multilink Open
Open: CDPCP, IPCP, TAGCP, loopback not set
DTR is pulsed for 2 seconds on reset
Last input 00:00:00, output never, output hang never
Last clearing of "show interface" counters 00:48:43
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
30 second input rate 0 bits/sec, 0 packets/sec
30 second output rate 0 bits/sec, 0 packets/sec
1340 packets input, 102245 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  1283 packets output, 101350 bytes, 0 underruns
  0 output errors, 0 collisions, 1 interface resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions

**Step 6** show MPLS forwarding-table

Displays contents of the Multiprotocol Label Switching (MPLS) Label Forwarding Information Base (LFIB). Look for information on multilink interfaces associated with a point2point next hop.

**Example:**

Device# show mpls forwarding-table

<table>
<thead>
<tr>
<th>Local</th>
<th>Outgoing</th>
<th>Prefix</th>
<th>Bytes</th>
<th>tag</th>
<th>Outgoing</th>
<th>Next Hop</th>
</tr>
</thead>
</table>

**MPLS Multilink PPP Support**
Use the `show ip bgp vpnv4` command to display VPN address information from the Border Gateway Protocol (BGP) table.

**Example:**

```
Device# show ip bgp vpnv4 all summary
```

BGP router identifier 10.0.0.1, local AS number 100
BGP table version is 21, main routing table version 21
10 network entries using 1210 bytes of memory
10 path entries using 640 bytes of memory
2 BGP path attribute entries using 120 bytes of memory
1 BGP extended community entries using 24 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
BGP using 1994 total bytes of memory
BGP activity 10/0 prefixes, 10/0 paths, scan interval 5 secs
10.0.0.3 4 100 MsgRc52 MsgSe52 TblV21 0 0 00:46:35 State/P5xRcd

Step 7  exit

Returns to user EXEC mode.

**Example:**

```
Device# exit
Device>
```

### Configuration Examples for MPLS Multilink PPP Support

#### Sample MPLS Multilink PPP Support Configurations

The following examples show sample configurations on a Carrier Supporting Carrier (CSC) network. The configuration of MLP on an interface is the same for provider edge-to-customer edge (PE-to-CE) links, PE-to-provider (P) links, and P-to-P links.

**Example: Configuring Multilink PPP on an MPLS CSC PE Device**

The following example shows how to configure for Multiprotocol Label Switching (MPLS) Carrier Supporting Carrier (CSC) provider edge (PE) device.

```
!  mpls label protocol ldp
  ip cef
  ip vrf vpn2
```
rd 200:1
route-target export 200:1
route-target import 200:1

controller T1 0/0/1
framing esf
clock source internal
linecode b8zs
channel-group 1 timeslots 1-24
interface Serial0/0:1
  no ip address
  encapsulation ppp

  ppp multilink
  ppp multilink group 1

interface Multilink1
  ip vrf forwarding vpn2
  ip address 10.35.0.2 255.0.0.0
  no peer neighbor-route
  load-interval 30
  ppp multilink
  ppp multilink interleave
  ppp multilink group 1
mpls ip
mpls label protocol ldp

router ospf 200
  log-adjacency-changes
  auto-cost reference-bandwidth 1000
  redistribute connected subnets
  passive-interface Multilink1
  network 10.0.0.7 0.0.0.0 area 200
  network 10.31.0.0 0.255.255.255 area 200

router bgp 200
  no bgp default ipv4-unicast
  bgp log-neighbor-changes
  neighbor 10.0.0.11 remote-as 200
  neighbor 10.0.0.11 update-source Loopback0

  address-family vpnv4
  neighbor 10.0.0.11 activate
  neighbor 10.0.0.11 send-community extended
  bgp scan-time import 5
  exit-address-family

  address-family ipv4 vrf vpn2
  redistribute connected
  neighbor 10.35.0.1 remote-as 300
  neighbor 10.35.0.1 activate
  neighbor 10.35.0.1 as-override
  neighbor 10.35.0.1 advertisement-interval 5
  no auto-summary
  no synchronization
  exit-address-family
Example: Creating a Multilink Bundle

The following example shows how to create a multilink bundle for the MPLS Multilink PPP Support feature:

```
Device(config)# interface multilink 1
Device(config-if)# ip address 10.0.0.0 10.255.255.255
Device(config-if)# encapsulation ppp
Device(config-if)# ppp chap hostname group 1
Device(config-if)# ppp multilink
Device(config-if)# ppp multilink group 1
Device(config-if)# mpls ip
Device(config-if)# mpls label protocol ldp
```

Example: Assigning an Interface to a Multilink Bundle

The following example shows how to create four multilink interfaces with Cisco Express Forwarding switching and Multilink PPP (MLP) enabled. Each of the newly created interfaces is added to a multilink bundle.

```
interface multilink1
  ip address 10.0.0.0 10.255.255.255
  ppp chap hostname group 1
  ppp multilink
  ppp multilink group 1
  mpls ip
  mpls label protocol ldp

interface serial 0/0/0:1
  no ip address
  encapsulation ppp
  ip route-cache cef
  no keepalive
  ppp multilink
  ppp multilink group 1
  no ip address
  encapsulation ppp
  ip route-cache cef
  no keepalive
  ppp chap hostname group 1
  ppp multilink
  ppp multilink group 1
  no ip address
  encapsulation ppp
  ip route-cache cef
  no keepalive
  ppp chap hostname group 1
  ppp multilink
  ppp multilink group 1
  no ip address
  encapsulation ppp
  ip route-cache cef
  no keepalive
  ppp chap hostname group 1
  ppp multilink
  ppp multilink group 1
```