MPLS OAM Commands

This module describes Multiprotocol Label Switching (MPLS) label switched path (LSP) verification commands. These commands provide a means to detect and diagnose data plane failures and are the first set of commands in the MPLS Operations, Administration, and Maintenance (OAM) solution.

For detailed information about MPLS concepts, configuration tasks, and examples, see *Cisco IOS XR MPLS Configuration Guide for the Cisco XR 12000 Series Router*.

clear mpls oam counters

To clear MPLS OAM counters, use the **clear mpls oam counters** command in EXEC mode.

clear mpls oam counters {**global**| **interface** [*type interface-path-id*]| **packet**}

Syntax Description

global	Clears global counters.
interface	Clears counters on a specified interface.
type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (**?**) online help function.
packet	Clears global packet counters.

Command Default   No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
mpls-te	execute
mpls-ldp	execute
mpls-static	execute

Examples   The following example shows how to clear all global MPLS OAM counters:

```
RP/0/0/CPU0:router# clear mpls oam counters global
```

echo disable-vendor-extension

To disable sending the vendor extension type length and value (TLV) in the echo request, use the **echo disable-vendor extension** command in MPLS OAM configuration mode. To return to the default behavior, use the **no** form of this command.

echo disable-vendor-extension

no echo disable-vendor-extension

Syntax Description   This command has no arguments or keywords.

Command Default   The default value is 4.

Command Modes   MPLS OAM configuration mode

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples   The following example shows how to disable inclusion of the vendor extensions TLV in the echo requests:

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# mpls oam
RP/0/0/CPU0:router(config-oam)# echo disable-vendor-extension
```

echo revision

To set the echo packet revision, use the **echo revision** command in MPLS OAM configuration mode. To return to the default behavior, use the **no** form of this command.

echo revision {**1** | **2** | **3** | **4** }

no echo revision

Syntax Description

1	2	3	4	Draft revision number:

• 1: draft-ietf-mpls-lsp-ping-03 (initial)

• 2: draft-ietf-mpls-lsp-ping-03 (rev 1)

• 3: draft-ietf-mpls-lsp-ping-03 (rev 2)

• 4: draft-ietf-mpls-lsp-ping-09 (initial)

Command Default   The default echo revision is 4 (in draft 9).

Command Modes   MPLS OAM configuration mode

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples   The following example shows how to set the echo packet default revision:

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# mpls oam
RP/0/0/CPU0:router(config-oam)# echo revision 1
```

mpls oam

To enable MPLS OAM LSP verification, use the **mpls oam** command in global configuration mode. To return to the default behavior, use the **no** form of this command.

mpls oam

no mpls oam

Syntax Description   This command has no arguments or keywords.

Command Default   By default, MPLS OAM functionality is disabled.

Command Modes   Global configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **mpls oam** command and OAM functionality is described in the IETF LSP ping draft.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write
mpls-static	read, write

Examples   The following example shows how to enable MPLS OAM:

```
RP/0/0/CPU0:router# configure
RP/0/0/CPU0:router(config)# mpls oam
RP/0/0/CPU0:router(config-oam)#
```

ping mpls ipv4

To check MPLS host reachability and network connectivity by specifying the destination type as a Label Distribution Protocol (LDP) IPv4 address, use the **ping mpls ipv4** command in EXEC mode.

ping mpls ipv4 *address/mask* [**destination** *start-address end-address increment*] **[dsmap]** [**exp** *exp-bits*] **[force-explicit-null]** [**interval** *min-send-delay*] [**output interface** *type interface-path-id* [**nexthop** *nexthop-address*]][**pad** *pattern*][**repeat** *count*] [**reply** {**dscp** *dscp-value* | **reply mode**{**ipv4** | **no-reply** | **router-alert**}| **reply pad-tlv**}] [**revision** *version*] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min value max value increment*] [**timeout** *timeout*] [**ttl** *value*] **[verbose]** [**fec-type** {**bgp** | **generic** | **ldp**}]

Syntax Description

address/mask	Address prefix of the target and number of bits in the target address network mask.
destination *start address end address address increment*	(Optional) Specifies a network 127/8 address to be used as the destination address in the echo request packet.
	start address
	Start of the network address.
	end address
	Start of the ending network address.
	address increment
	Incremental value of the network address, which is expressed as a decimal number value or IP address.
dsmap	(Optional) Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.

output interface	(Optional) Specifies the output interface where echo request packets are sent.
type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information, use the question mark (**?**) online help function.
nexthop	(Optional) Specifies the nextop as an IP address.
nexthop-iaddress	(Optional) IP address for the next hop.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	Specifies the differentiated service codepoint value for an MPLS echo reply.

reply mode [**ipv4** | **router-alert** | **no-reply**]	Specifies the reply mode for the echo request packet.
	
	no-reply
	   Do not reply
	
	ipv4
	   Reply with an IPv4 UDP packet (this is the default)
	
	router-alert
	   Reply with an IPv4 UDP packet with the IP router alert set

reply pad-tlv	Indicates that a pad TLV should be included.

revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 draft-ietf-mpls-lsp-ping-03 (initial) • 2 draft-ietf-mpls-lsp-ping-03 (rev 1) • 3 draft-ietf-mpls-lsp-ping-03 (rev 2) • 4 draft-ietf-mpls-lsp-ping-09 (initial)
size *packet size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
sweep *min value max value interval*	(Optional) Specifies a range of sizes for the echo packets sent. *min value* Minimum or start size for an echo packet (range is 100 to 17986) *max value* Maximum or end size for an echo packet(range is 100 to 17986) *interval* Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp bits*: 0

interval *min-send-delay*: 0

repeat *count* : 5

reply-mode: IPv4

timeout *timeout* : 2

Command Modes   EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.1	Sample output was modified.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **output interface** keyword specifies the output interface on which the MPLS echo request packets are sent. If the specified output interface is not part of the LSP, the packets are not transmitted.

In cases where the sweep keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then awaits a reply. Ping output can help you evaluate path-to-host reliability, delays over the path, and whether the host can be reached or is functioning.

Note   The **ping mpls** command is not supported on optical LSPs. If an optical LSP is encountered along the LSP's path, it is treated as a physical interface.

For detailed configuration information about the MPLS **ping** command, see *Cisco IOS XR System Monitoring Configuration Guide for the Cisco XR 12000 Series Router*.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples   The following example shows the destination type as a label distribution protocol (LDP) prefix and specifies a range of sizes for the echo packets sent:

```
RP/0/0/CPU0:router# ping mpls ipv4 140.140.140/32 verbose sweep 100 200 15 repeat 1

  Sending 1, [100..200]-byte MPLS Echos to 140.140.140.140/32,
      timeout is 2 seconds, send interval is 0 msec:

  Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
    'L' - labeled output interface, 'B' - unlabeled output interface,
    'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
    'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
    'P' - no rx intf label prot, 'p' - premature termination of LSP,
```

```
                'R' - transit router, 'I' - unknown upstream index,
                'X' - unknown return code, 'x' - return code 0

          Type escape sequence to abort.
          !    size 100, reply addr 196.100.1.26, return code 3
          !    size 115, reply addr 196.100.1.26, return code 3
          !    size 130, reply addr 196.100.1.26, return code 3
          !    size 145, reply addr 196.100.1.26, return code 3
          !    size 160, reply addr 196.100.1.26, return code 3
          !    size 175, reply addr 196.100.1.26, return code 3
          !    size 190, reply addr 196.100.1.26, return code 3

          Success rate is 100 percent (7/7), round-trip min/avg/max = 5/6/8 ms
```

The following example shows the destination type as a label distribution protocol (LDP) prefix and specifies FEC type as generic and verbose option:

```
RP/0/0/CPU0:router# ping mpls ipv4 11.11.11.11/32 fec-type generic output interface
gigabitEthernet 0/0/0/3
nexthop 172.40.103.2 verbose

Sending 5, 100-byte MPLS Echos to 11.11.11.11/32,
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3
!      size 100, reply addr 11.101.11.11, return code 3

Success rate is 100 percent (5/5), round-trip min/avg/max = 3/4/6 ms
```

ping mpls traffic-eng

To specify the destination type as an MPLS-TE tunnel and tunnel interface, use the **ping mpls traffic-eng** command in EXEC mode.

ping mpls traffic-eng tunnel *tunnel-ID* [**dsmap**] [**exp** *exp-bits*] [**force-explicit-null**] [**interval** *min-send-delay*] [**pad** *pattern*] [**repeat** *count*] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **no-reply** | **router-alert**}| **reply pad-tlv**}] [**revision** *version*] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min-value max-value increment*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel *tunnel-ID*	Specifies the destination type as an MPLS traffic engineering (TE) tunnel and the tunnel interface number. The range for the tunnel interface number is from 0 to 65535.
dsmap	(Optional) Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode [**ipv4** | **router-alert** | **no-reply**]	(Optional) Specifies the reply mode for the echo request packet. **no-reply** — Do not reply. **ipv4** — Reply with an IPv4 UDP packet (this is the default). **router-alert** — Reply with an IPv4 UDP packet with the IP router alert set.
reply pad-tlv	(Optional) Indicates that a pad TLV should be included.

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revision *version*	(Optional) Specifies the Cisco extension TLV versioning field:
	• 1 draft-ietf-mpls-lsp-ping-03 (initial)
	• 2 draft-ietf-mpls-lsp-ping-03 (rev 1)
	• 3 draft-ietf-mpls-lsp-ping-03 (rev 2)
	• 4 draft-ietf-mpls-lsp-ping-09 (initial)
size *packet-size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
sweep *min-value max-value interval*	(Optional) Specifies a range of sizes for the echo packets sent.
	min-value
	Minimum or start size for an echo packet (range is 100 to 17986)
	max-value
	Maximum or end size for an echo packet(range is 100 to 17986)
	interval
	Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits*: 0

interval *min-send-delay*: 0

repeat *count*: 5

reply-mode: IPv4

timeout *timeout* : 2

Command Modes   EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.
Release 3.4.1	Sample output was modified.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **output interface** keyword specifies the output interface on which the MPLS echo request packets are sent. If the specified output interface is not part of the LSP, the packets are not transmitted.

In cases where the **sweep** keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then awaits a reply. Ping output can help you evaluate path-to-host reliability, delays over the path, and whether the host can be reached or is functioning.

> **Note** The **ping mpls traffic-eng** command is not supported on optical LSPs. If an optical LSP is encountered along the LSP's path, it is treated as a physical interface.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows how to check connectivity by using the **ping mpls traffic-eng** command when a TE tunnel 10 is present. Return code, reply address, and packet size are displayed due to the **verbose** keyword.

```
RP/0/0/CPU0:router# ping mpls traffic-eng tunnel 10 repeat 1 verbose

  Sending 1, 100-byte MPLS Echos to tunnel-te10,
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
!    size 100, reply addr 196.100.1.18, return code 3

Success rate is 100 percent (1/1), round-trip min/avg/max = 15/15/15 ms
```

Related Commands

Command	Description
show mpls traffic-eng tunnels	Displays information about MPLS-TE tunnels.
ping mpls traffic-eng tunnel-te (P2P)	Verifies the connectivity of the LSP path for the MPLS-TE tunnel.

ping pseudowire (AToM)

To verify connectivity between provider edge (PE) LSRs in an Any Transport over MPLS (AToM) setup, use the **ping pseudowire** command in EXEC mode.

ping [mpls] pseudowire *remote-PE -address pw-id* [**exp** *exp-bits*] [**interval** *min-send-delay*] [**pad** *pattern*] [**repeat** *count*] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **no-reply** | **router-alert** | **control-channel**}| **reply pad-tlv**}] [**size** *packet-size*] [**source** *source-address*] [**sweep** *min-value max-value increment*] [**timeout** *timeout*] [**ttl** *value*] **[verbose]**

Syntax Description

mpls	(Optional) Verifies the Labeled Switch Path (LSP).
remote-PE address	IP address of the remote PE LSR.
pw-id	Pseudowire ID that identifies the pseudowire in which MPLS connectivity is being verified. The pseudowire is used to send the echo request packets. The range is from 1 to 4294967295.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
pad *pattern*	(Optional) Specifies the pad pattern for an echo request.
repeat *count*	(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

reply mode {**ipv4** | **router-alert** | **no-reply** | **control-channel**}	(Optional) Specifies the reply mode for the echo request packet.
	no-reply
	Do not reply
	ipv4
	Reply with an IPv4 UDP packet (the default)
	router-alert
	Reply with an IPv4 UDP packet with the IP router alert set
	control-channel
	Force the use of a VCCV control channel.
	Reply using an application for a defined control channel. This applies only to pseudowires in which VCCV is used in the reply path. This is the default choice for pseudowire ping.
reply pad-tlv	(Optional) Indicates that a reply pad TLV should be included.
size *packet-size*	(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
sweep *min-value max-value interval*	Specifies a range of sizes for the echo packets sent.
	min-value
	Minimum or start size for an echo packet (range is 100 to 17986)
	max-value
	Maximum or end size for an echo packet(range is 100 to 17986)
	interval
	Number used to increment an echo packet size(range is 1 to 8993)
timeout *timeout*	(Optional) Specifies the timeout interval in seconds. Range is 0 to 3600. Default is 2 seconds.
ttl *value*	(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).

verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp bits*: 0

interval *min-send-delay*: 0

repeat *count*: 5

reply-mode: IPv4

timeout *timeout* : 2

Command Modes　　EXEC

Command History

Release	Modification
Release 3.4.1	This command was introduced.
Release 3.9.0	The following keywords and arguments were added: • **force-control-channel**, **control-word**, **ra-label** and **ttl-expiry** keywords were added.

Usage Guidelines　　To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

In cases in which the **sweep** keyword is used, values larger than the outgoing interface's MTU are not transmitted.

The **ping** command sends an echo request packet to an address, and then awaits a reply. Ping output can help you evaluate path-to-host reliability, delays over the path, and whether the host can be reached or is functioning.

Note　　The **ping mpls** command is not supported on optical LSPs. If an optical LSP is encountered along the LSP's path, it is treated as a physical interface.

AToM VCCV allows the sending of control packets inband of an AToM pseudowire (PW) from the originating provider edge (PE) router. The transmission is intercepted at the destination PE router, instead of being forwarded to the customer edge (CE) router. This lets you use MPLS LSP ping to test the pseudowire section of AToM virtual circuits (VCs).

The no interactive version of the **ping pseudowire (AToM)** command is supported.

The control word setting is either enabled along the entire path between the Terminating-Provider Edge (T-PE) or it is completely disabled. If the control word configuration is enabled on one segment and disabled on another segment, the multisegment pseudowire does not come up.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows how the **ping mpls pseudowire** command is used to verify PE to PE connectivity in which the remote PE address is 150.150.150.150. Only one echo request packet is sent and the remote PE is to answer using IPv4 instead of the control channel.

```
RP/0/0/CPU0:router# ping mpls pseudowire 150.150.150.150 21 repeat 1 reply mode ipv4

  Sending 1, 100-byte MPLS Echos to 150.150.150.150 VC: 21,
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
   'L' - labeled output interface, 'B' - unlabeled output interface,
   'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
   'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
   'P' - no rx intf label prot, 'p' - premature termination of LSP,
   'R' - transit router, 'I' - unknown upstream index,
   'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
!
Success rate is 100 percent (1/1), round-trip min/avg/max = 23/23/23 ms
```

ping mpls mldp (P2MP)

To check data plane and control plane of MPLS for the Point-to-Multipoint (P2MP) label switch path, use the **ping mpls mldp p2mp** command in EXEC mode.

ping mpls mldp p2mp *root-address* {**IPv4** *source-ipv4-address group-ipv4-address*| **IPv6** *source-ipv6-address group-ipv6-address*| **vpnv4** *AS-number* [*source-ipv4-address group-ipv4-address*]| **vpnv6** *AS-number* [*source-ipv6-address group-ipv6-address*]| **mdt** *oui:vpn-index mdt-number*| **global-id** *lsp-id*} **[options]**

Syntax Description

mldp	Verifies the ping capability for multicast label distribution protocol (mldp).
p2mp	Indicates the Point-to-Multipoint (P2MP) label switch path.
root-address	Specifies the root address.
IPv4 *ipv4-address*	Defines IPv4 opaque encoding.
IPv6 *ipv6-address*	Defines IPv6 opaque encoding.
vpnv4 *AS-number* [*source-ipv4-address group-ipv4-address*]	Defines VPNv4 opaque encoding.
vpnv6 *AS-number* [*source-ipv6-address group-ipv6-address*]	Defines VPNv6 opaque encoding.
mdt *oui:vpn-index mdt number*	Defines VPN ID opaque encoding. Range of 3-byte OUI is 0 to 16777215. Range of *mdt-number* is 0 to 4294967295.
global-id *isp-id*	Defines 4 byte global LSP ID opaque encoding.
source-address	Specifies the source address of target multicast address.
group-address	Specifies the target address of target multicast address.
AS-number	Specifies the Autonomous system number as follows: • 4-byte AS-number with asdot (X.Y) : aa.bb:cc format (for example, 11.22:33) • 2-byte AS-number or4-byte AS-number: aa:bb format (for example, 11:22) • IPv4 address and index:aa.bb.cc.dd:ee format (for example, 11.22.33.44:55)

options

Specifies a set of various options:

ddmap

> (Optional) Indicates that a downstream detailed mapping TLV (ddmap) should be included in the LSP echo request.

destination

> (Optional) Specifies a network 127/8 address to be used as the destination address in the echo request packet.
>
> **start-address**: Start of the network address.
>
> **end-address**: End of the network address.
>
> **address increment**: Incremental value of the network address, which is expressed as a decimal number value or IP address.

exp*exp-bits*

> (Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.

flags

> **fec**: (Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
>
> **no-ttl**: (Optional) Specifies not to add TTL expired flag in echo request.

force-explicit-null

> (Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.

interval *min-send-delay*

> (Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.

jitter

> (Optional) Specifies a jitter value for a corresponding echo request, in milliseconds.

Range is 0 to 2147483647. Default is 200.

pad *pattern*

(Optional) Specifies the pad pattern for an echo request.

repeat *count*

(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.

reply dscp dscp-value

(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

mode [ipv4 | router-alert]

(Optional) Specifies the reply mode for the echo request packet.

ipv4

Reply with an IPv4 UDP packet (this is the default)

router-alert

Reply with an IPv4 UDP packet with the IP router alert set

responder-id *ipv4-address*

(Optional) Adds responder identifier into corresponding echo request.

size*packet size*

(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.

source *ipv4-address*

(Optional) Specifies the source address used in the echo request packet.

sweep

(Optional)

timeout *timeout*

(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.

ttl

(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255). Default is 255.

verbose

(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default   No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 4.1.1	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operation
basic-services	execute
mpls-te	read
mpls-ldp	read

Examples   The following examples show how to check connectivity for P2MP by using the **ping mpls mldp p2mp** command.

```
RP/0/0/CPU0:routerping mpls mldp p2mp 192.168.0.1 ipv4 2.2.2.2 232.1.1.1
```

```
Sending 1, 100-byte MPLS Echos to mldp p2mp 192.168.0.1 ipv4 (2.2.2.2, 232.1.1.1),
      timeout is 2.2 seconds, send interval is 0 msec, jitter value is 200 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0, 'd' - DDMAP

Type escape sequence to abort.

Request #1
! reply addr 11.11.11.3
! reply addr 12.12.12.4

Round-trip min/avg/max = 17/27/38 ms

RP/0/0/CPU0:router#ping mpls mldp p2mp 192.168.0.1 ipv4 2.2.2.2 232.1.1.1 ddmap ttl 1

Sending 1, 100-byte MPLS Echos to mldp p2mp 192.168.0.1 ipv4 (2.2.2.2, 232.1.1.1),
      timeout is 2.2 seconds, send interval is 0 msec, jitter value is 200 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0, 'd' - DDMAP

Type escape sequence to abort.

Request #1
d reply addr 10.10.10.2
  [L] DDMAP 0: 11.11.11.3 11.11.11.3 MRU 1500 [Labels: 16016 Exp: 0]
  [L] DDMAP 1: 12.12.12.4 12.12.12.4 MRU 1500 [Labels: 16016 Exp: 0]
```

This table describes the significant fields shown in the display:

Opaque Type	Opaque Value	Supported Multicast Application	Signaling
IPv4	S, G	PIM-SSM transit of IPv4	In-Band
IPv6	S, G	PIM-SSM transit of IPv6	In-Band
MDT	VPN-ID, MDT#	mVPN Default-MDT (MDT# = 0) mVPN Data-MDT (MDT# > 0)	In-Band
Global ID	4 byte value	BGP Assigned LSPs	Out-of-Band
VPNv4	(S,G), VPN-ID	VPNv4	In-Band
VPNv6	(S,G), VPN-ID	VPNv6	In-Band

Related Commands

Command	Description
ping mpls mldp (MP2MP), on page 28	Verifies data plane and control plane for the Multipoint-to-Multipoint (MP2MP) label switch path.
traceroute mpls mldp (P2MP), on page 50	Verifies hop-by-hop fault localization and path tracing for the point-to-multipoint path.
traceroute mpls mldp (MP2MP), on page 56	Verifies hop-by-hop fault localization and path tracing for the multipoint-to-multipoint path.

ping mpls mldp (MP2MP)

To check data plane and control plane of MPLS for the Multipoint-to-Multipoint (MP2MP) label switch path, use the **ping mpls mldp mp2mp** command in exec mode.

ping mpls mldp mp2mp *root-address* {**IPv4** *source-ipv4-address group-ipv4-address*| **IPv6** *source-ipv6-address group-ipv6-address*| **vpnv4** *AS-number* [*source-ipv4-address group-ipv4-address*]| **vpnv6** *AS-number* [*source-ipv6-address group-ipv6-address*]| **mdt** *oui:vpn-index mdt-number*| **global-id** *lsp-id*} **[options]**

Syntax Description		
mldp	Verifies the ping capability for multicast label distribution protocol (mldp).	
mp2mp	Indicates the Multipoint-to-Multipoint (MP2MP) label switch path.	
root-address	Specifies the root address.	
IPv4 *ipv4-address*	Defines IPv4 opaque encoding.	
IPv6 *ipv6-address*	Defines IPv6 opaque encoding.	
vpnv4 *AS-number* [*source-ipv4-address group-ipv4-address*]	Defines VPNv4 opaque encoding.	
vpnv6 *AS-number*[*source-ipv6-address group-ipv6-address*]	Defines VPNv6 opaque encoding.	
mdt *oui:vpn-index mdt number*	Defines VPN ID opaque encoding. Range of 3-byte OUI is 0 to 16777215. Range of *mdt-number* is 0 to 4294967295.	
global-id *lsp-id*	Defines 4 byte global LSP ID opaque encoding.	
source-address	Specifies the source address of target multicast address.	
group-address	Specifies the target address of target multicast address.	
AS-number	Specifies the Autonomous system number as follows: • 4-byte AS-number with asdot (X.Y) : aa.bb:cc format (for example, 11.22:33) • 2-byte AS-number or4-byte AS-number: aa:bb format (for example, 11:22) • IPv4 address and index:aa.bb.cc.dd:ee format (for example, 11.22.33.44:55)	

options

Specifies a set of various options:

ddmap

> (Optional) Indicates that a downstream detailed mapping TLV (ddmap) should be included in the LSP echo request.

destination

> (Optional) Specifies a network 127/8 address to be used as the destination address in the echo request packet.
>
> **start-address**: Start of the network address.
>
> **end-address**: End of the network address.
>
> **address increment**: Incremental value of the network address, which is expressed as a decimal number value or IP address.

exp *exp-bits*

> (Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.

flags

> **fec**: (Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
>
> **no-ttl**: (Optional) Specifies not to add TTL expired flag in echo request.

force-explicit-null

> (Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.

interval *min-send-delay*

> (Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.

jitter

> (Optional) Specifies a jitter value for a corresponding echo request, in milliseconds.

Range is 0 to 2147483647. Default is 200.

pad *pattern*

(Optional) Specifies the pad pattern for an echo request.

repeat *count*

(Optional) Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.

reply dscp dscp-value

(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

mode [ipv4 | router-alert]

(Optional) Specifies the reply mode for the echo request packet.

ipv4

Reply with an IPv4 UDP packet (this is the default)

router-alert

Reply with an IPv4 UDP packet with the IP router alert set

responder-id *ipv4-address*

(Optional) Adds responder identifier into corresponding echo request.

size*packet size*

(Optional) Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.

source *ipv4-address*

(Optional) Specifies the source address used in the echo request packet.

sweep

(Optional)

timeout *timeout*

(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.

ttl

(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255). Default is 255.

verbose

(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default   No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 4.1.1	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operation
basic-services	execute
mpls-te	read
mpls-ldp	read

Examples   The following example shows how to check connectivity by using the **ping mpls mldp** command when a root address is present.

```
RP/0/0/CPU0:routerping mpls mldp mp2mp 192.168.0.1 global-id 1
```

```
                   Mon Jul 11 15:35:50.294 JST

                   Sending 1, 100-byte MPLS Echos to mldp mp2mp 192.168.0.1 global-id 1,
                         timeout is 2.2 seconds, send interval is 0 msec, jitter value is 200 msec:

                   Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
                     'L' - labeled output interface, 'B' - unlabeled output interface,
                     'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
                     'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
                     'P' - no rx intf label prot, 'p' - premature termination of LSP,
                     'R' - transit router, 'I' - unknown upstream index,
                     'X' - unknown return code, 'x' - return code 0, 'd' - DDMAP

                   Type escape sequence to abort.

                   Request #1
                   ! reply addr 10.10.10.2
                   ! reply addr 12.12.12.4
                   ! reply addr 11.11.11.3

                   Round-trip min/avg/max = 72/112/135 ms


                   RP/0/0/CPU0:router#ping mpls mldp mp2mp 192.168.0.1 global-id 1 responder-id 11.11.11.3
                   Mon Jul 11 15:36:16.038 JST

                   Sending 1, 100-byte MPLS Echos to mldp mp2mp 192.168.0.1 global-id 1,
                         timeout is 2.2 seconds, send interval is 0 msec, jitter value is 200 msec:

                   Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
                     'L' - labeled output interface, 'B' - unlabeled output interface,
                     'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
                     'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
                     'P' - no rx intf label prot, 'p' - premature termination of LSP,
                     'R' - transit router, 'I' - unknown upstream index,
                     'X' - unknown return code, 'x' - return code 0, 'd' - DDMAP

                   Type escape sequence to abort.

                   Request #1
                   ! reply addr 11.11.11.3

                   Round-trip min/avg/max = 163/163/163 ms
```

This table describes the significant fields shown in the display:

Opaque Type	Opaque Value	Supported Multicast Application	Signaling
IPv4	S, G	PIM-SSM transit of IPv4	In-Band
IPv6	S, G	PIM-SSM transit of IPv6	In-Band
MDT	VPN-ID, MDT#	mVPN Default-MDT (MDT# = 0) mVPN Data-MDT (MDT# > 0)	In-Band
Global ID	4 byte value	BGP Assigned LSPs	Out-of-Band
VPNv4	(S,G), VPN-ID	VPNv4	In-Band
VPNv6	(S,G), VPN-ID	VPNv6	In-Band

Related Commands

Command	Description
ping mpls mldp (P2MP), on page 21	Verifies data plane and control plane for the point-to-multipoint (P2MP) label switch path.
traceroute mpls mldp (P2MP), on page 50	Verifies hop-by-hop fault localization and path tracing for the point-to-multipoint path.
traceroute mpls mldp (MP2MP), on page 56	Verifies hop-by-hop fault localization and path tracing for the multipoint-to-multipoint path.

show mpls oam

To display MPLS OAM information, use the **show mpls oam** command in EXEC mode.

show mpls oam {**client**| **counters** {**global**| **packet**}| **interface** *type interface-path-id*}

Syntax Description

client	Displays clients registered with LSPV server.
counters global	Displays LSP verification global counters.
counters packet	Displays LSP verification packet counters.
counters interface	Displays LSP verification information for a specific interface.
type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information about the syntax for the router, use the question mark (**?**) online help function.

Command Default   No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 3.5.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read

Task ID	Operations
mpls-static	read

Examples

The following example shows how to display MPLS OAM client information:

```
RP/0/0/CPU0:router# show mpls oam client

  Client Process: l2vpn_mgr Node: 0/0/SP Pid: 418014
  Client Process: te_control Node: 0/0/SP Pid: 639227
```

This table describes the significant fields shown in the display.

Table 1: show mpls oam client Command Field Descriptions

Field	Description
Client Process	Process of client.

show mpls oam database

To display MPLS OAM database information, use the **show mpls oam database** command in EXEC mode.

show mpls oam database { **requests** | **tt-requests**} **[detail]** [**handle** *handle-value*]

Syntax Description

requests	Displays request database
tt-requests	Displays tree trace request database
detail	(Optional) Displays displayed information.
handle	(Optional) Displays handle information.
handle-value	Generic handle value. Range is from 0 to 4294967295.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.5.0	This command was introduced.
Release 3.9.0	The *handle-value* argument was added.
Release 4.0.0	The **replies** keyword was removed.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operations
mpls-te	read
mpls-ldp	read
mpls-static	read

Examples   The following example shows how to display detailed MPLS OAM database information:

```
RP/0/0/CPU0:router# show mpls oam database request detail
```

traceroute mpls ipv4

To learn the routes that packets follow when traveling to their Label Distribution Protocol (LDP) IPv4 destination, use the **traceroute mpls** command in EXEC mode.

traceroute mpls ipv4*address/mask* [**destination** *start-address end-address address-increment*] [**exp** *exp-bits*] [**flags fec**] [**force-explicit-null**] [**output interface** *type interface-path-id* [**nexthop** *nexthop-address*]] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **router-alert**}}] [**revision** *version*] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**] [**fec-type** {**bgp** | **generic** | **ldp**}]

Syntax Description

address/mask	Specifies the destination type as a label distribution protocol (LDP) prefix. Address prefix of the target and number of bits in the target address network mask.
destination *start-address end-address address-increment*	Specifies a network 127 address to be used as the destination address in the echo request packet. ***start address*** Start of the network address. ***end address*** End of the network address. ***address increment*** Incremental value of the network address.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
output interface	(Optional) Specifies the output interface in which echo request packets are sent.
type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information, use the question mark (**?**) online help function.

nexthop	(Optional) Specifies the IP address for the next hop.
nexthop-address	(Optional) IP address for the next hop.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.
reply mode { **ipv4** | **router-alert**}	(Optional) Specifies the reply mode for the echo request packet.
	ipv4
	Reply with IPv4 UDP packet (this is the default)
	router-alert
	Reply with IPv4 UDP packet with router alert
revision *version*	(Optional) Specifies the Cisco extension TLV versioning field:
	• 1 draft-ietf-mpls-lsp-ping-03 (initial)
	• 2 draft-ietf-mpls-lsp-ping-03 (rev 1)
	• 3 draft-ietf-mpls-lsp-ping-03 (rev 2)
	• 4 draft-ietf-mpls-lsp-ping-09 (initial)
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeoutt*	(Optional) Specifies the timeout interval, in seconds. Range is from 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the maximum number of hops (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits*: 0

reply mode: IPv4

timeout *timeout*: 2

Command Modes EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Note   The **traceroute mpls** command is not supported on optical LSPs. If an optical LSP is encountered along the LSPs path, it is treated as a physical interface.

For detailed configuration information about MPLS LSP trace operations, see *Cisco IOS XR System Monitoring Configuration Guide for the Cisco XR 12000 Series Router*.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples   The following example shows how to trace a destination:

```
RP/0/0/CPU0:router# traceroute mpls ipv4 140.140.140.140/32
destination 127.0.0.10 127.0.0.15.1


Tracing MPLS Label Switched Path to 140.140.140.140/32, timeout is 2
seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

Destination address 127.0.0.10

  0 196.100.1.41 MRU 4470 [Labels: 19 Exp: 0]
L 1 196.100.1.42 MRU 4470 [Labels: 86 Exp: 0] 360 ms
  2 196.100.1.50 MRU 4470 [Labels: implicit-null Exp: 0] 8 ms
! 3 196.100.1.18 9 ms
```

The following example shows how to trace a destination with FEC type specified as generic and verbose option:

```
RP/0/0/CPU0:router# traceroute mpls ipv4 11.11.11.11/32 fec-type generic output interface
gigabitEthernet 0/0/0/3
nexthop 172.40.103.2 verbose


Tracing MPLS Label Switched Path to 11.11.11.11/32, timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
```

```
        'P' - no rx intf label prot, 'p' - premature termination of LSP,
        'R' - transit router, 'I' - unknown upstream index,
        'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

  0 172.40.103.1 172.40.103.2 MRU 1500 [Labels: 16038 Exp: 0]
L 1 172.40.103.2 173.101.103.1 MRU 1500 [Labels: 16037 Exp: 0] 6 ms, ret code 8
L 2 173.101.103.1 11.101.11.11 MRU 1500 [Labels: implicit-null Exp: 0] 4 ms, ret code 8
! 3 11.101.11.11 6 ms, ret code 3
```

traceroute mpls multipath

To discover all possible paths of an LSP between the ingress and egress routers, use the **traceroute mpls multipath** command in EXEC mode.

traceroute mpls multipath ipv4 *address/mask* [**destination** *start-address end-address address-increment*] [**exp** *exp-bits*] [**flags fec**] [**force-explicit-null**] [**hashkey ipv4 bitmap** *bit-size*] [**interval** *min-send-delay*] [**output interface** *type interface-path-id* [**nexthop** *nexthop-address*]] [**reply** {**dscp** *dscp-value* | **reply mode**{**ipv4** | **router-alert**}}] [**retry-count** *count*] [**revision** *version*] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**] [**fec-type** {**bgp** | **generic** | **ldp**}]

Syntax Description

ipv4	Specifies the destination type as a Label Distribution Protocol (LDP) IPv4 address.
address/mask	Address prefix of the target and number of bits in the target address network mask.

destination *start-address end-address address-increment*	(Optional) Specifies a network 127 address to be used as the destination address in the echo request packet.
	
	start-address
	
	    Start of the network address.
	
	end-address
	
	    End of the network address.
	
	address-increment
	
	    Incremental value of the network address.

exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
hashkey ipv4 bitmap *bit-size*	(Optional) Allows user control of the hash key/multipath settings. Range is 0 to 256. The default is 32.
interval *min-send-delay*	(Optional) Specifies a send interval, in milliseconds, between requests. Range is 0 to 3600000. Default is 0.
output interface	(Optional) Specifies the output interface where echo request packets are sent.

type	Interface type. For more information, use the question mark (**?**) online help function.
interface-path-id	Physical interface or virtual interface. **Note** Use the **show interfaces** command to see a list of all interfaces currently configured on the router. For more information, use the question mark (**?**) online help function.
nexthop	(Optional) Specifies the IP address for the next hop.
nexthop-address	(Optional) IP address for the next hop.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

reply mode [**ipv4** | **router-alert**]	(Optional) Specifies the reply mode for the echo request packet.
	
	ipv4
	
	    Reply with IPv4 UDP packet (this is the default)
	
	router-alert
	
	    Reply with IPv4 UDP packet with router alert

retry-count *count*	(Optional) Specifies the number of retry attempts during multipath LSP traceroute. A retry is attempted if an outstanding echo request • times out waiting for the corresponding echo reply. • fails to find a valid destination address set to exercise a specific outgoing path. Range is 0 to 10. Default is 3.
revision *version*	(Optional) Specifies the Cisco extension TLV versioning field: • 1 draft-ietf-mpls-lsp-ping-03 (initial) • 2 draft-ietf-mpls-lsp-ping-03 (rev 1) • 3 draft-ietf-mpls-lsp-ping-03 (rev 2) • 4 draft-ietf-mpls-lsp-ping-09 (initial)
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is from 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the maximum number of hops (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits* : 0

hashkey ipv4 bitmap *bit-size*: 4

interval *min-send-delay*: 0

reply mode: IPv4

retry-count: 3

timeout *timeout* : 2

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **hashkey ipv4 bitmap** keyword and *bit-size* value control how many addresses are encoded in the DSMAP multipath field. Larger values allow more coverage of equal cost multiple paths throughout the network, but with more processing at the head, mid, and tail routers.

Task ID

Task ID	Operations
mpls-te	read, write
mpls-ldp	read, write

Examples

The following example shows how to specify the destination type as an LDP IPv4 prefix:

```
RP/0/0/CPU0:router# traceroute mpls multi ipv4 140.140.140.140/32 verbose
force-explicit-null

  Starting LSP Path Discovery for 140.140.140.140/32

  Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

  Type escape sequence to abort.

  LL!
```

```
 Path 0 found,
 output interface POS0/2/0/3 source 196.100.1.61 destination 127.0.0.1
 0 196.100.1.61 196.100.1.62 MRU 4470 [Labels: 18/explicit-null Exp: 0/0] multipaths 0
 L 1 196.100.1.62 196.100.1.10 MRU 4470 [Labels: 17/explicit-null Exp: 0/0] ret code 8
multipaths 1
 L 2 196.100.1.10 196.100.1.18 MRU 4470 [Labels: implicit-null/explicit-null Exp: 0/0] ret
 code 8 multipaths 1
 ! 3 196.100.1.1018, ret code 3 multipaths 0
 LL!
 Path 1 found,
 output interface GigabitEthernet0/3/0/0 source 196.100.1.5 destination 127.0.0.1
 0 196.100.1.5 196.100.1.37 6 MRU 1500 [Labels: 18/explicit-null Exp: 0/0] multipaths 0
 L 1 196.100.1.6 196.100.1.10 MRU 4470 [Labels: 17/explicit-null Exp: 0/0] ret code 8
multipaths 1
 L 2 10196.0100.21.5 1010 196.0100.21.10 18 MRU 4470 [Labels: implicit-null/explicit-null
 Exp: 0/0] ret code 8 multipaths 1
 ! 3 10196.0100.21.1018, ret code 3 multipaths 0

 Paths (found/broken/unexplored) (2/0/0)
 Echo Request (sent/fail) (6/0)
 Echo Reply (received/timeout) (6/0)
 Total Time Elapsed 80 ms
```

The following example shows how to specify the FEC type as LDP with verbose option:

```
RP/0/0/CPU0:router#  traceroute mpls multipath ipv4 11.11.11.11/32 fec-type ldp output
interface gigabitEthernet 0/0/0/3
nexthop 172.40.103.2 verbose

Starting LSP Path Discovery for 11.11.11.11/32

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

LL!
Path 0 found,
 output interface GigabitEthernet0/0/0/3 nexthop 172.40.103.2
 source 172.40.103.1 destination 127.0.0.0
  0 172.40.103.1 172.40.103.2 MRU 1500 [Labels: 16038 Exp: 0] multipaths 0
L 1 172.40.103.2 173.101.103.1 MRU 1500 [Labels: 16037 Exp: 0] ret code 8 multipaths 1
L 2 173.101.103.1 11.101.11.11 MRU 1500 [Labels: implicit-null Exp: 0] ret code 8 multipaths
 1
! 3 11.101.11.11, ret code 3 multipaths 0

Paths (found/broken/unexplored) (1/0/0)
 Echo Request (sent/fail) (3/0)
 Echo Reply (received/timeout) (3/0)
 Total Time Elapsed 21 ms
```

traceroute mpls traffic-eng

To specify the destination type as an MPLS traffic engineering (TE) tunnel, use the **traceroute mpls traffic-eng** command in EXEC mode.

traceroute mpls traffic-eng tunnel *tunnel-ID* [**destination** *start-address end-address address-increment increment-mask*] [**exp** *exp-bits*] [**flags fec**] [**force-explicit-null**] [**reply** {**dscp** *dscp-value* | **reply mode** {**ipv4** | **router-alert**}}] [**revision** *version*] [**source** *source-address*] [**timeout** *timeout*] [**ttl** *value*] [**verbose**]

Syntax Description

tunnel	Specifies the MPLS-TE tunnel type.
tunnel-ID	Tunnel interface.

destination *start-address end-address address -increment increment-mask*	(Optional) Specifies a network 127 address to be used as the destination address in the echo request packet.
	
	start-address
	    Start of the network address.
	
	end-address
	    End of the network address.
	
	address-increment
	    Incremental value of the network address.
	
	increment-mask
	    Incremental mask of the network address.

exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	(Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.
reply dscp *dscp-value*	(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

reply mode [**ipv4** | **router-alert**]	(Optional) Specifies the reply mode for the echo request packet.
	ipv4
	Reply with IPv4 UDP packet (this is the default)
	router-alert
	Reply with IPv4 UDP packet with router alert
revision *version*	(Optional) Specifies the Cisco extension TLV versioning field:
	• 1 draft-ietf-mpls-lsp-ping-03 (initial)
	• 2 draft-ietf-mpls-lsp-ping-03 (rev 1)
	• 3 draft-ietf-mpls-lsp-ping-03 (rev 2)
	• 4 draft-ietf-mpls-lsp-ping-09 (initial)
source *source-address*	(Optional) Specifies the source address used in the echo request packet.
timeout *timeout*	(Optional) Specifies the timeout interval, in seconds. Range is from 0 to 3600. Default is 2.
ttl *value*	(Optional) Specifies the maximum number of hops (range is 1 to 255).
verbose	(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default

exp *exp-bits* : 0

reply mode: IPv4

timeout *timeout* : 2

Command Modes

EXEC

Command History

Release	Modification
Release 3.9.0	This command was introduced.
Release 4.0.0	This command was replaced by the **traceroute mpls traffic-eng tunnel-te (P2P)** command.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operation
mpls-te	read
mpls-ldp	read

Examples   The following example shows how to specify the destination as a MPLS-TE tunnel:

```
RP/0/0/CPU0:router#  traceroute mpls traffic-eng tunnel 13

Tracing MPLS TE Label Switched Path on tunnel-te13, timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

 0 0.0.0.0 11.0.0.1 MRU 1500 [Labels: 16003 Exp: 0]
 L 1 192.168.200.2 192.168.170.1 MRU 1500 [Labels: implicit-null Exp: 0] 110 ms
 ! 2 192.168.170.1 0.0.0.0 MRU 0 [No Label] 169 ms
```

Related Commands

Command	Description
ping mpls traffic-eng tunnel-te (P2P)	Displays information about MPLS-TE tunnel for a point-to-point connection.

traceroute mpls mldp (P2MP)

To verify hop-by-hop fault localization and path tracing for the point-to-multipoint path, use the **traceroute mpls mldp p2mp** command in EXEC mode.

traceroute mpls mldp p2mp *root-address* {**IPv4** *source-ipv4-address group-ipv4-address*| **IPv6** *source-ipv6-address group-ipv6-address*| **vpnv4** *AS-number* [*source-ipv4-address group-ipv4-address*]| **vpnv6** *AS-number* [*source-ipv6-address group-ipv6-address*]| **mdt** *oui:vpn-index mdt-number*| **global-id** *lsp-id*} **[options]**

Syntax Description

mldp	Verifies the ping capability for multicast label distribution protocol (mldp).
p2mp	Indicates the Point-to-Multipoint (P2MP) label switch path.
root-address	Specifies the root address.
IPv4 *ipv4-address*	Defines IPv4 opaque encoding.
IPv6 *ipv6-address*	Defines IPv6 opaque encoding.
vpnv4 *AS-number* [*source-ipv4-address group-ipv4-address*]	Defines VPNv4 opaque encoding.
vpnv6 *AS-number*[*source-ipv6-address group-ipv6-address*]	Defines VPNv6 opaque encoding.
mdt *oui:vpn-index mdt number*	Defines VPN ID opaque encoding. Range of 3-byte OUI is 0 to 16777215. Range of *mdt-number* is 0 to 4294967295.
global-id *lsp-id*	Defines 4 byte global LSP ID opaque encoding.
source-address	Specifies the source address of target multicast address.
group-address	Specifies the target address of target multicast address.
AS-number	Specifies the Autonomous system number as follows: • 4-byte AS-number with asdot (X.Y) : aa.bb:cc format (for example, 11.22:33) • 2-byte AS-number or4-byte AS-number: aa:bb format (for example, 11:22) • IPv4 address and index:aa.bb.cc.dd:ee format (for example, 11.22.33.44:55)

options

Specifies a set of various options:

destination

(Optional) Specifies a network 127/8 address to be used as the destination address in the echo request packet.

start-address: Start of the network address.

end-address: End of the network address.

address increment: Incremental value of the network address, which is expressed as a decimal number value or IP address.

exp*exp-bits*

(Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.

flags

fec: (Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.

no-ttl: (Optional) Specifies not to add TTL expired flag in echo request.

force-explicit-null

(Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.

jitter

(Optional) Specifies a jitter value for a corresponding echo request, in milliseconds. Range is 0 to 2147483647. Default is 200.

reply dscp dscp-value

(Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

mode [ipv4 | router-alert]

(Optional) Specifies the reply mode for the echo request packet.

ipv4

Reply with an IPv4 UDP packet (this is the default)

router-alert

Reply with an IPv4 UDP packet with the IP router alert set

responder-id *ipv4-address*

(Optional) Adds responder identifier into corresponding echo request.

source *ipv4-address*

(Optional) Specifies the source address used in the echo request packet.

timeout *timeout*

(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.

ttl

(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255). Default is 255.

verbose

(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default   No default behavior or values

Command Modes   EXEC

Command History

Release	Modification
Release 4.1.1	This command was introduced.

Usage Guidelines   To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operation
basic-services	execute
mpls-te or mpls-ldp	read

Examples   The following examples show how to verify path tracing for P2MP by using the **traceroute mpls mldp p2mp** command.

```
RP/0/0/CPU0:router#traceroute mpls mldp p2mp 192.168.0.1 ipv4 2.2.2.2 232.1.1.1 ttl 4
Mon Jul 11 15:36:42.299 JST

Tracing MPLS Label Switched Path to mldp p2mp 192.168.0.1 ipv4 (2.2.2.2, 232.1.1.1),
     timeout is 2.2 seconds, jitter value is 200 msec

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0, 'd' - DDMAP

Type escape sequence to abort.

d 1 10.10.10.2 54 ms [Estimated Role: Branch]
    [L] DDMAP 0: 11.11.11.3 11.11.11.3 MRU 1500 [Labels: 16016 Exp: 0]
    [L] DDMAP 1: 12.12.12.4 12.12.12.4 MRU 1500 [Labels: 16016 Exp: 0]

! 2 11.11.11.3 47 ms [Estimated Role: Egress]
! 2 12.12.12.4 68 ms [Estimated Role: Egress]
. 3 *
. 4 *


RP/0/0/CPU0:router#traceroute mpls mldp p2mp 192.168.0.1 ipv4 2.2.2.2 232.1.1.1 ttl 4 jitter
 300
Mon Jul 11 15:37:18.976 JST

Tracing MPLS Label Switched Path to mldp p2mp 192.168.0.1 ipv4 (2.2.2.2, 232.1.1.1),
     timeout is 2.3 seconds, jitter value is 300 msec

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0, 'd' - DDMAP

Type escape sequence to abort.

d 1 10.10.10.2 77 ms [Estimated Role: Branch]
    [L] DDMAP 0: 11.11.11.3 11.11.11.3 MRU 1500 [Labels: 16016 Exp: 0]
    [L] DDMAP 1: 12.12.12.4 12.12.12.4 MRU 1500 [Labels: 16016 Exp: 0]

! 2 12.12.12.4 15 ms [Estimated Role: Egress]
```

```
! 2 11.11.11.3 114 ms [Estimated Role: Egress]
. 3 *
. 4 *
```

Related Commands

Command	Description
ping mpls mldp (P2MP), on page 21	Verifies data plane and control plane for the point-to-multipoint (P2MP) label switch path.
traceroute mpls mldp (MP2MP), on page 56	Verifies hop-by-hop fault localization and path tracing for the multipoint-to-multipoint path.

traceroute mpls mldp (MP2MP)

To verify hop-by-hop fault localization and path tracing for the multipoint-to-multipoint path (MP2MP), use the **traceroute mpls mldp mp2mp** command in EXEC mode.

traceroute mpls mldp mp2mp *root-address* {**IPv4** *source-ipv4-address group-ipv4-address*| **IPv6** *source-ipv6-address group-ipv6-address*| **vpnv4** *AS-number* [*source-ipv4-address group-ipv4-address*]| **vpnv6** *AS-number* [*source-ipv6-address group-ipv6-address*]| **mdt** *oui:vpn-index mdt-number*| **global-id** *lsp-id*} **[options]**

Syntax Description

mldp	Verifies the ping capability for multicast label distribution protocol (mldp).
mp2mp	Indicates the Multipoint-to-Multipoint (MP2MP) label switch path.
root-address	Specifies the root address.
IPv4 *ipv4-address*	Defines IPv4 opaque encoding.
IPv6 *ipv6-address*	Defines IPv6 opaque encoding.
vpnv4 *AS-number* [*source-ipv4-address group-ipv4-address*]	Defines VPNv4 opaque encoding.
vpnv6 *AS-number*[*source-ipv6-address group-ipv6-address*]	Defines VPNv6 opaque encoding.
mdt *oui:vpn-index mdt number*	Defines VPN ID opaque encoding. Range of 3-byte OUI is 0 to 16777215. Range of *mdt-number* is 0 to 4294967295.
global-id*lsp-id*	Defines 4 byte global LSP ID opaque encoding.
source-address	Specifies the source address of target multicast address.
group-address	Specifies the target address of target multicast address.
AS-number	Specifies the Autonomous system number as follows: • 4-byte AS-number with asdot (X.Y) : aa.bb:cc format (for example, 11.22:33) • 2-byte AS-number or4-byte AS-number: aa:bb format (for example, 11:22) • IPv4 address and index:aa.bb.cc.dd:ee format (for example, 11.22.33.44:55)

options

Specifies a set of various options:

destination

> (Optional) Specifies a network 127/8 address to be used as the destination address in the echo request packet.

> **start-address**: Start of the network address.

> **end-address**: End of the network address.

> **address increment**: Incremental value of the network address, which is expressed as a decimal number value or IP address.

exp*exp-bits*

> (Optional) Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.

flags

> **fec**: (Optional) Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.

> **no-ttl**: (Optional) Specifies not to add TTL expired flag in echo request.

force-explicit-null

> (Optional) Forces an unsolicited explicit null label to be added to the MPLS label stack and allows LSP ping to be used to detect LSP breakages at the penultimate hop.

jitter

> (Optional) Specifies a jitter value for a corresponding echo request, in milliseconds. Range is 0 to 2147483647. Default is 200.

reply dscp-value

> (Optional) Specifies the differentiated service codepoint value for an MPLS echo reply.

> **mode [ipv4 | router-alert]**

> (Optional) Specifies the reply mode for the echo request packet.

> **ipv4**

Reply with an IPv4 UDP packet (this is the default)

router-alert

Reply with an IPv4 UDP packet with the IP router alert set

responder-id *ipv4-address*

(Optional) Adds responder identifier into corresponding echo request.

source *ipv4-address*

(Optional) Specifies the source address used in the echo request packet.

timeout *timeout*

(Optional) Specifies the timeout interval, in seconds. Range is 0 to 3600. Default is 2.

ttl

(Optional) Specifies the TTL value to be used in the MPLS labels (range is 1 to 255). Default is 255.

verbose

(Optional) Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Command Default   **ttl** *255* **jitter** *200*

Command Modes   EXEC

Command History

Release	Modification
Release 4.1.1	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Task ID

Task ID	Operation
basic-services	execute
mpls-te or mpls-ldp	read

Examples

The following examples show how to verify path tracing for MP2MP by using the **traceroute mpls mldp mp2mp** command.

```
RP/0/0/CPU0:router#traceroute mpls mldp mp2mp 192.168.0.1 global-id 1 ttl 4

Tracing MPLS Label Switched Path to mldp mp2mp 192.168.0.1 global-id 1,
    timeout is 2.2 seconds, jitter value is 200 msec

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0, 'd' - DDMAP

Type escape sequence to abort.

! 1 10.10.10.2 41 ms [Estimated Role: Bud]
    [L] DDMAP 0: 11.11.11.3 11.11.11.3 MRU 1500 [Labels: 16020 Exp: 0]
    [L] DDMAP 1: 12.12.12.4 12.12.12.4 MRU 1500 [Labels: 16020 Exp: 0]

! 2 11.11.11.3 16 ms [Estimated Role: Egress]
! 2 12.12.12.4 17 ms [Estimated Role: Egress]
. 3 *
. 4 *
```

Related Commands

Command	Description
ping mpls mldp (MP2MP), on page 28	Verifies data plane and control plane for the multipoint-to-multipoint (MP2MP) label switch path.
traceroute mpls mldp (P2MP), on page 50	Verifies hop-by-hop fault localization and path tracing for the point-to-multipoint path.