MPLS OAM Commands on Cisco IOS XR Software

This chapter 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, refer to the *Cisco IOS XR MPLS Configuration Guide*.

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 [*interface-id* | **all**] | **packet**}

Syntax Description

global	Clears global counters.
interface *interface-id*	Clears counters on a specified interface.
packet	Clears global packet counters.

Defaults

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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/RP0/CPU0:router# clear mpls oam counters global
```

clear mpls oam echo

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

clear mpls oam echo {disable-vendor-extension | revision {**1** | **2** | **3** | **4**}}

Syntax Description

disable-vendor-extension	Disables sending TLV vendor extensions with echo requests.
revision	Echo packet default revision.
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)

Defaults

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

Task ID

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

Examples

The following example shows how to disable sending TLV vendor extensions with echo requests:

```
RP/0/RP0/CPU0:router# clear mpls oam echo disable-vendor-extension
```

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 submode. 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.

Defaults

By default, the vendor extension TLV is sent in each request. The default value is 4.

Command Modes

MPLS OAM configuration submode

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/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 submode. 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)

Defaults

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

Command Modes

MPLS OAM configuration submode

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/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.

Defaults

By default, MPLS OAM functionality is disabled.

Command Modes

Global configuration

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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/RP0/CPU0:router# configure
RP/0/RP0/CPU0:router(config)# mpls oam
RP/0/RP0/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 *addr/mask***} [destination {***start address} {end address} {address increment}***] | [dsmap] | [exp** *exp bits in MPLS header***] | [force-explicit-null] | [interval** *send interval between requests in msec***] | [output interface** *echo request output interface***] [pad** *pad TLV pattern***] | [repeat** *repeat count***] | [reply dscp** *differentiated services codepoint value***] | [reply mode [ipv4 | router-alert | no-reply] | [reply pad-tlv]] | [revision** *echo packet tlv versioning***] | [{size** *packet size***} | [source** *source specified as an IP address***] | {sweep** {*min value*} {*max value*} {*increment*}**] | [timeout** *timeout in seconds***] | [ttl** *time to live***] | [verbose]**

Syntax Description

addr/mask	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 127/8 address to be used as the destination address in the echo request packet. • *start address* specifies the starting network address • *end address* specifies the ending network address • *address increment* specifies the incremental value of the network address, which is expressed as a decimal number value or IP address
dsmap	Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
exp *exp bits in MPLS header*	Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
force-explicit-null	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 *send interval between requests in msec*	Specifies a send interval between requests (in milliseconds). Range is 0 to 3600000. Default is 0.
output interface *echo request output interface*	Specifies the output interface where echo request packets are sent.
pad *pad tlv pattern*	Specifies the pad pattern for an echo request.
repeat *repeat count*	Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *differentiated services codepoint 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 *echo packet tlv versioning*	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*	Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.
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)
source *source specified as an IP address*	Specifies the source address used in the echo request packet.
timeout *timeout in seconds*	Specifies the timeout interval in seconds. Range is 0 to 3600. Default is 2 seconds.
ttl *time to live*	Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Defaults

exp *exp bits in MPLS header: 0*

interval *send interval between requests in msec: 0*

repeat *repeat count:* 5

reply-mode: *ipv4*

timeout *timeout in seconds*: 2 seconds

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.4.1	Sample output was modified.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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 the section entitled "Configuring IP SLA MPLS LSP Ping and Trace Operations" in *Implementing IP Service Level Agreements on Cisco IOS XR Software*.

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/RP0/CPU0:router# ping mpls ipv4 140.140.140.140/32 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
```

ping mpls pseudowire

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

ping mpls pseudowire {*remote-PE address*} {*pw-id*} **[exp** *exp bits in MPLS header*] **| [interval** *send interval between requests in msec*] **[pad** *pad TLV pattern*] **| [repeat** *repeat count*] **| [reply dscp** *differentiated services codepoint value*] **| [reply mode** {**ipv4 | router-alert | no-reply | control-channel**}] **| [reply pad-tlv] | [revision** *echo packet tlv versioning*] **| [{size** *packet size*} **| [source** *source specified as an IP address*] **| {sweep** {*min value*} {*max value*} {*increment*}] **| [timeout** *timeout in seconds*] **| [ttl** *time to live*] **| [verbose]**

Syntax Description

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.
dsmap	Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
exp *exp bits in MPLS header*	Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
interval *send interval between requests in msec*	Specifies a send interval between requests (in milliseconds). Range is 0 to 3600000. Default is 0.
pad *pad tlv pattern*	Specifies the pad pattern for an echo request.
repeat *repeat count*	Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *differentiated services codepoint value*	Specifies the differentiated service codepoint value for an MPLS echo reply.
reply-mode {**ipv4 | router-alert | no-reply | control-channel**}	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**: Reply with a 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	Indicates that a pad TLV should be included.
revision *echo packet tlv versioning*	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*	Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.

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)
source *source specified as an IP address*	Specifies the source address used in the echo request packet.
timeout *timeout in seconds*	Specifies the timeout interval in seconds. Range is 0 to 3600. Default is 2 seconds.
ttl *time to live*	Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Defaults

exp *exp bits in MPLS header*: *0*

interval *send interval between requests in msec*: *0*

repeat *repeat count:* 5

reply-mode: *ipv4*

timeout *timeout in seconds*: 2 seconds

Command Modes

EXEC

Command History

Release	Modification
Release 3.4.1	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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 mpls pseudowire** command is supported.

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/RP0/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 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 {tunnel *intf num***} [dsmap] | [exp** *exp bits in MPLS header***] | [force-explicit-null] | [interval** *send interval between requests in msec***] | [pad** *pad TLV pattern***] | [repeat** *repeat count***] | [reply dscp** *differentiated services codepoint value***] | [reply mode [ipv4 | router-alert | no-reply] | [reply pad-tlv] | [revision** *echo packet tlv versioning***] | [{size** *packet size***} | [source** *source specified as an IP address***] | {sweep** {*min value*} {*max value*} {*increment*}**] | [timeout** *timeout in seconds***] | [ttl** *time to live***] | [verbose]**

Syntax Description

tunnel *intf num*	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	Indicates that a downstream mapping (DSMAP) type length and value should be included in the LSP echo request.
exp *exp bits in MPLS header*	Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
force-explicit-null	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 *send interval between requests in msec*	Specifies a send interval between requests (in milliseconds). Range is 0 to 3600000. Default is 0.
pad *pad tlv pattern*	Specifies the pad pattern for an echo request.
repeat *repeat count*	Specifies the number of times to resend a packet. Range is 1 to 2147483647. Default is 5.
reply dscp *differentiated services codepoint 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 *echo packet tlv versioning*	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*	Specifies the packet size or number of bytes in each MPLS echo request packet. Range is 100 to 17986. Default is 100.

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)
source *source specified as an IP address*	Specifies the source address used in the echo request packet.
timeout *timeout in seconds*	Specifies the timeout interval in seconds. Range is 0 to 3600. Default is 2 seconds.
ttl *time to live*	Specifies the TTL value to be used in the MPLS labels (range is 1 to 255).
verbose	Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Defaults

exp *exp bits in MPLS header*: *0*

interval *send interval between requests in msec*: *0*

repeat *repeat count*: 5

reply-mode: *ipv4*

timeout *timeout in seconds*: 2 seconds

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.4.1	Sample output was modified.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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.

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/RP0/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
```

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** *interface-id*}

Syntax Description

client	Displays clients registered with LSPV server.
counters	Displays LSP verification counters.
global	Displays global counters.
packet	Displays packet counters.
interface *interface-id*	Displays selected information on a specified interface.

Defaults

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.5.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

Task ID

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

Examples

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

```
RP/0/RP0/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
```

Table 85 describes the significant fields shown in the display.

Table 85 show mpls oam client Field Descriptions

Field	Description
Client Process	Displays the client process.

show mpls oam database

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

show mpls oam database {**replies** | **requests** | **tt-requests**} {**detail** | **handle**}

Syntax Description

replies	Displays replies database.
requests	Displays request database
tt-requests	Displays tree trace request database
detail	Displays displayed information.
handle	Displays handle information.

Defaults

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 3.5.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

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/RP0/CPU0:router# show mpls oam database request detail
```

traceroute mpls

To learn the routes that packets follow when travelling to their destinations., use the **traceroute mpls** command in EXEC mode.

traceroute mpls {{ipv4 *addr/mask***} | {traffic-eng tunnel** *tunnel intf num***}} [destination {***start address} {end address} {address increment}***] | [exp** *exp bits in MPLS header***] | [flags fec] | [force-explicit-null] | [output interface** *echo request output interface***] | [reply dscp** *DSCP bits in reply IP header***] | [reply mode** [*ipv4 | router-alert | no-reply*]**] [revision** *echo packet tlv versioning***] | [source** *source specified as an IP address***] | [timeout** *timeout in seconds***] | [ttl** *time to live***] | [verbose]**

Syntax Description

ipv4	Specifies the destination type as a Label Distribution Protocol (LDP) prefix.
addr/mask	Address prefix of the target and number of bits in the target address network mask.
traffic-eng tunnel *tunnel intf num*	Specifies the destination type as an MPLS traffic engineering (TE) tunnel and tunnel interface.
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* specifies the starting network address • *end address* specifies the ending network address • *address increment* specifies the incremental value of the network address
exp *exp bits in MPLS header*	Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	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 *echo request output interface*	Specifies the output interface where echo request packets are sent.
reply dscp *differentiated services codepoint 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. • *ipv4*: Reply with IPv4 UDP packet (this is the default) • *router-alert*: Reply with IPv4 UDP packet with router alert
revision *echo packet tlv versioning*	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 specified as an IP address*	Specifies the source address used in the echo request packet.
timeout *timeout in seconds*	Specifies the timeout interval in seconds. Range is from 0 to 3600. Default is 2 seconds.
ttl *time to live*	Specifies the maximum number of hops (range is 1 to 255).
verbose	Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Defaults

exp *exp bits in MPLS header: 0*

interval *send interval between requests in msec: 0*

reply-mode: *ipv4*

timeout *timeout in seconds*: 2 seconds

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

Note The **mpls traceroute** 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 MPLS LSP trace operations, see the section entitled "Configuring and Scheduling an MPLS LSP Trace Operation" in *Implementing IP Service Level Agreements on Cisco IOS XR Software*.

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/RP0/CPU0:router# traceroute

Protocol [ipv4]: mpls
Target IPv4 or traffic-eng [ipv4]:
Target IPv4 address: 140.140.140.140
Target mask: 255.255.255.255
Timeout in seconds [2]:
Extended commands? [no]: yes
Destination address or destination start address: 127.0.0.10
Destination end address: 127.0.0.15
Destination address increment: 1
Source address:
EXP bits in mpls header [0]:
Maximum Time To Live [30]:
Reply mode (2-ipv4 via udp, 3-ipv4 via udp with router alert) [2]:
LSP ping/trace revision (1-draft 3 initial, 2-draft 3 rev 1, 3-draft 3 rev 2, 4-draft 9
initial) [4]:
Force explicit null label? [no]:
Reply IP header DSCP bits [0]:
Check the FEC stack at transit routers? [no]:

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
L 2 196.100.1.50 MRU 4470 [Labels: implicit-null Exp: 0] 8 ms
! 3 196.100.1.18 9 ms
```

traceroute mpls multipath

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

traceroute mpls multipath {{ipv4 *addr/mask***} | {traffic-eng tunnel** *tunnel intf num***}} [destination** {*start address} {end address} {address increment}*] **| [exp** *exp bits in MPLS header*] **| [flags fec] | [force-explicit-null]** | [**hashkey ipv4 bitmap** *multipath bit size*] | [**interval** *send interval between requests in msec*] | [**output interface** *echo request output interface*] | [**reply dscp** *DSCP bits in reply IP header*] | [**reply mode** [*ipv4* | *router-alert* | *no-reply*]] | [**retry-count** *echo request retry count*] | **[revision** *echo packet TLV versioning***] | [source** *source specified as an IP address*] **| [timeout** *timeout in seconds*] **| [ttl** *time to live*] **| [verbose**]

Syntax Description

ipv4	Specifies the destination type as a Label Distribution Protocol (LDP) IPv4 address.
addr/mask	Address prefix of the target and number of bits in the target address network mask.
traffic-eng tunnel *tunnel intf num*	Specifies the destination type as an MPLS traffic engineering (TE) tunnel and tunnel interface.
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* specifies the starting network address • *end address* specifies the ending network address • *address increment* specifies the incremental value of the network address
exp *exp bits in MPLS header*	Specifies the MPLS experimental field value in the MPLS header for echo replies. Range is 0 to 7. Default is 0.
flags fec	Specifies that forwarding equivalent class (FEC) stack checking is to be performed at transit routers.
force-explicit-null	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 *multipath bit size*	Allows user control of the hash key/multipath settings. Range is 0 to 256. The default is 32.
interval *send interval between requests in msec*	Specifies a send interval between requests (in milliseconds). Range is 0 to 3600000. Default is 0.
output interface *echo request output interface*	Specifies the output interface where echo request packets are sent.
reply dscp *differentiated services codepoint 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. • *ipv4*: Reply with IPv4 UDP packet (this is the default) • *router-alert*: Reply with IPv4 UDP packet with router alert

retry-count *echo request retry count*	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 *echo packet tlv versioning*	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 specified as an IP address*	Specifies the source address used in the echo request packet.
timeout *timeout in seconds*	Specifies the timeout interval in seconds. Range is from 0 to 3600. Default is 2 seconds.
ttl *time to live*	Specifies the maximum number of hops (range is 1 to 255).
verbose	Enables verbose output information, including MPLS echo reply, sender address of the packet, and return codes.

Defaults

exp *exp bits in MPLS header: 0*

hashkey ipv4 bitmap *multipath bit size: 4*

interval *send interval between requests in msec: 0*

reply-mode: *ipv4*

retry-count: 3

timeout *timeout in seconds*: 2 seconds

Command Modes

EXEC

Command History

Release	Modification
Release 3.3.0	This command was introduced on the Cisco CRS-1 and Cisco XR 12000 Series Router.
Release 3.4.0	No modification.
Release 3.5.0	No modification.
Release 3.6.0	No modification.
Release 3.7.0	No modification.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the proper task IDs. For detailed information about user groups and task IDs, see the *Configuring AAA Services on Cisco IOS XR Software* module of the *Cisco IOS XR System Security Configuration Guide*.

The **hashkey ipv4 bitmap** *multipath bit size* value controls 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/RP0/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
! 3 196.100.1.18, 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
0 196.100.1.5 196.100.1.6 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 2 196.100.1.10 196.100.1.18 MRU 4470 [Labels: implicit-null/explicit-null Exp: 0/0] ret
code 8 multipaths 1
! 3 196.100.1.18, 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
```