Configure Performance Measurement

Network performance metrics is a critical measure for traffic engineering (TE) in service provider networks. Network performance metrics include the following:

- Packet loss

- Delay

- Delay variation

- Bandwidth utilization

These network performance metrics provide network operators information about the performance characteristics of their networks for performance evaluation and help to ensure compliance with service level agreements. The service-level agreements (SLAs) of service providers depend on the ability to measure and monitor these network performance metrics. Network operators can use Segment Routing Performance Measurement (SR-PM) feature to monitor the network metrics for links and end-to-end TE label switched paths (LSPs).

The following table explains the functionalities supported by performance measurement feature for measuring delay for links or SR policies.

Table 1: Performance Measurement Functionalities

Functionality	Details
Profiles	You can configure different profiles for different types of delay measurements. Delay profile type interfaces is used for link-delay measurement. Delay profile type sr-policy is used for SR policy delay measurements. Delay profile allows you to schedule probe and configure metric advertisement parameters for delay measurement.
Protocols	Two-Way Active Measurement Protocol (TWAMP) Light (using RFC 5357 with IP/UDP encap).
Probe and burst scheduling	Schedule probes and configure metric advertisement parameters for delay measurement.
Metric advertisements	Advertise measured metrics periodically using configured thresholds. Also supports accelerated advertisements using configured thresholds.
Measurement history and counters	Maintain packet delay and loss measurement history and also session counters and packet advertisement counters.

Liveness Monitoring

Liveness refers to the ability of the network to confirm that a specific path, segment, or a node is operational and capable of forwarding packets. Liveness checks are essential for maintaining network availability and reliability.

Benefits

- **Fault Detection**: You can quickly identify if a device is down, which allows for immediate response and troubleshooting.

- **Load Balancing**: You can identify if the devices in a network are live, so work can be distributed more evenly across the network, preventing overloading of specific components and improving overall performance.

- **System Health**: You can provide an ongoing snapshot of a system's health, helping to identify potential issues before they become significant problems.

- **Maintenance Planning**: Liveness information can also help with maintenance planning, as system administrators can understand which components are live or down and plan maintenance and downtime accordingly without significant disruption to services.

- **Security**: Regular liveness checks can also play a role in maintaining network security. Administrators can take proactive steps to mitigate the damage and prevent future incidents by identifying unusual activity that might indicate a security breach or attack.

You can determine liveness for SR Policy and IP Endpoint.

Delay Measurement

Delay measuremnt is a mechanism used to measure the latency or delay experienced by data packets when they traverse a network.

The PM for delay measuremnt uses the IP/UDP packet format defined in RFC 5357 (TWAMP-Light) for probes. Two-Way Active Measurement Protocol (TWAMP) adds two-way or round-trip measurement capabilities. TWAMP employs time stamps applied at the echo destination (reflector) to enable greater accuracy. In the case of TWAMP Light, the Session-Reflector doesn't necessarily know about the session state. The Session-Reflector simply copies the Sequence Number of the received packet to the Sequence Number field of the reflected packet. The controller receives the reflected test packets and collects two-way metrics. This architecture allows for collection of two-way metrics.

Benefits

- Network Troubleshooting: You can quickly and easily identify areas in your network with high delay and resolve network problems using delay measurement.

- Network Planning and Optimization: You can easily understand the performance of your network under various conditions and design a network that can handle expected traffic loads.

- Quality of Service (QoS): You can ensure quality of service standards are being met by continuously monitoring the delay in your network.

Supported Delay Measurement Methods

You can measure delay using the following methods:

- Use to monitor delay experienced by data packets in a single link or path between two nodes in a network.

- : Use to monitor the amount of time it takes for a data packet to travel from a source device to a specific IP endpoint within a network.

- : Use to to monitor the end-to-end delay experienced by the traffic sent over an SR policy.

Link Delay Measurement

Table 2: Feature History Table

Feature Name	Release Information	Feature Description
Link Delay Measurement using TWAMP Light Encoding	Release 7.3.1	The PM for link delay uses the IP/UDP packet format defined in RFC 5357 (TWAMP-Light) for probes. Two-Way Active Measurement Protocol (TWAMP) adds two-way or round-trip measurement capabilities. TWAMP employs time stamps applied at the echo destination (reflector) to enable greater accuracy.

The PM for link delay uses the IP/UDP packet format defined in RFC 5357 (TWAMP-Light) for probes. Two-Way Active Measurement Protocol (TWAMP) adds two-way or round-trip measurement capabilities. TWAMP employs time stamps applied at the echo destination (reflector) to enable greater accuracy. In the case of TWAMP Light, the Session-Reflector doesn't necessarily know about the session state. The Session-Reflector simply copies the Sequence Number of the received packet to the Sequence Number field of the reflected packet. The controller receives the reflected test packets and collects two-way metrics. This architecture allows for collection of two-way metrics.

The following figure explains the PM query and response for link delay.

Figure 1: Performance Measurement for Link Delay

One Way Delay = (T2 − T1)
Two-Way Delay = ((T2 − T1) + (T4 − T3))/2

367557
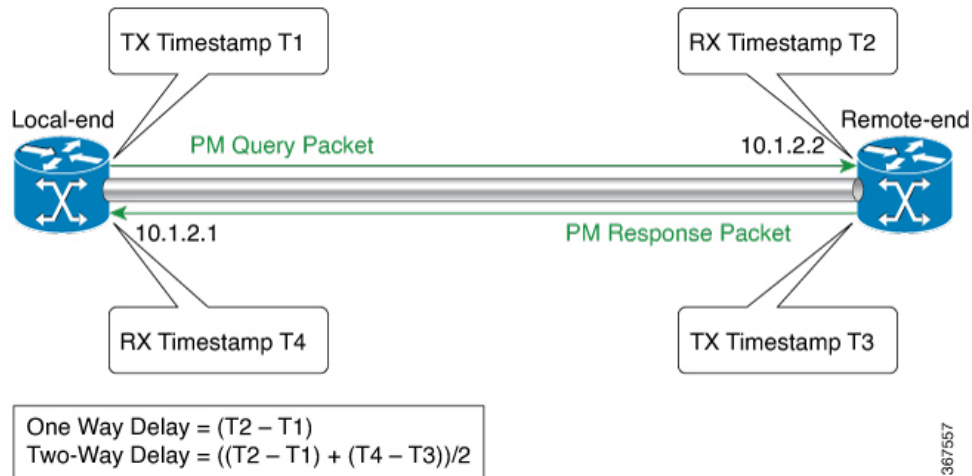
The PM query and response for link delay can be described in the following steps:

1. The local-end router sends PM query packets periodically to the remote side once the egress line card on the router applies timestamps on packets.

2. Ingress line card on the remote-end router applies time-stamps on packets as soon as they are received.

3. The remote-end router sends the PM packets containing time-stamps back to the local-end router. The remote-end router time-stamps the packet just before sending it for two-way measurement.

4. The local-end router time-stamps the packet as soon as the packet is received for two-way measurement.

5. One-way delay and optionally two-way delay is measured using the time-stamp values in the PM packet.

Restrictions and Usage Guidelines for PM for Link Delay

The following restrictions and guidelines apply for the PM for link delay feature for different links.

- For LSPs, remote-end line card needs to be MPLS and multicast MAC address capable.

- For broadcast links, only point-to-point (P2P) links are supported. P2P configuration on IGP is required for flooding the value.

- For link bundles, the hashing function may select a member link for forwarding but the reply may come from the remote line card on a different member link of the bundle.

- For one-way delay measurement, clocks should be synchronized on two end-point nodes of the link using PTP.

- Link delay measurement is supported on IPv4 unnumbered interfaces. An IPv4 unnumbered interface is identified by a node ID (a loopback address) and the local SNMP index assigned to the interface. Note that the reply messages could be received on any interface, since the packets are routed at the responder based on the loopback address used to identify the link.

Configuration Example: PM for Link Delay

This example shows how to configure performance-measurement functionalities for link delay as a global default profile. The default values for the different parameters in the PM for link delay is given as follows:

- **probe measurement mode**: The default measurement mode for probe is two-way delay measurement. If you are configuring one-way delay measurement, hardware clocks must be synchronized between the local-end and remote-end routers using precision time protocol (PTP).

- **protocol**: Interface delay measurement uses TWAMP-Light (RFC5357) with IP/UDP encap.

- **burst-interval**: Interval for sending probe packet. The default value is 3000 milliseconds and the range is from 30 to 15000 milliseconds.

- **computation interval**: Interval for metric computation. Default is 30 seconds; range is 1 to 3600 seconds.

- **periodic advertisement**: Periodic advertisement is enabled by default.

- **periodic-advertisement interval**: The default value is 120 seconds and the interval range is from 30 to 3600 seconds.

- **periodic-advertisement threshold**: The default value of periodic advertisement threshold is 10 percent.

- **periodic-advertisement minimum change**: The default value is 1000 microseconds (usec) and the range is from 0 to 10000 microseconds.

- **accelerated advertisement**: Accelerated advertisement is disabled by default.

- **accelerated-advertisement threshold**: The default value is 20 percent and the range is from 0 to 100 percent.

- **accelerated-advertisement minimum change**: The default value is 1000 microseconds and the range is from 1 to 100000 microseconds.

```
RP/0/0/CPU0:router(config)# performance-measurement delay-profile interfaces
RP/0/0/CPU0:router(config-pm-dm-intf)# probe
RP/0/0/CPU0:router(config-pm-dm-intf-probe)# measurement-mode one-way
RP/0/0/CPU0:router(config-pm-dm-intf-probe)# burst-interval 60
RP/0/0/CPU0:router(config-pm-dm-intf-probe)# exit

RP/0/0/CPU0:router(config-pm-dm-intf)# advertisement periodic
RP/0/0/CPU0:router(config-pm-dm-intf-adv-per)# interval 120
RP/0/0/CPU0:router(config-pm-dm-intf-adv-per)# threshold 20
RP/0/0/CPU0:router(config-pm-dm-intf-adv-per)# minimum-change 1000
RP/0/0/CPU0:router(config-pm-dm-intf-adv-per)# exit

RP/0/0/CPU0:router(config-pm-dm-intf)# advertisement accelerated
RP/0/0/CPU0:router(config-pm-dm-intf-adv-acc)# threshold 30
RP/0/0/CPU0:router(config-pm-dm-intf-adv-acc)# minimum-change 1000
RP/0/0/CPU0:router(config-pm-dm-intf-adv-per)# exit
```

Configure the UDP Destination Port

Configuring the UDP port for TWAMP-Light protocol is optional. By default, PM uses port 862 as the TWAMP-reserved UDP destination port.

The UDP port is configured for each PM measurement probe type (delay, loss, protocol, authentication mode, etc.) on querier and responder nodes. If you configure a different UDP port, the UDP port for each PM measurement probe type must match on the querier and the responder nodes.

Note   The same UDP destination port is used for delay measurement for links and SR Policy.

This example shows how to configure the UDP destination port.

```
Router(config)# performance-measurement
Router(config-perf-meas)# protocol twamp-light
Router(config-pm-protocol)# measurement delay unauthenticated
Router(config-pm-proto-mode)# querier-dst-port 12000
```

Enable PM for Link Delay Over an Interface

This example shows how to enable PM for link delay over an interface.

```
RP/0/0/CPU0:router(config)# performance-measurement
RP/0/0/CPU0:router(config-perf-meas)# interface TenGigE0/0/0/0
RP/0/0/CPU0:router(config-pm-intf)# delay-measurement
RP/0/0/CPU0:router(config-pm-dm-intf)# exit
```

Verification

```
RP/0/0/CPU0:router# show performance-measurement profile interface
Thu Dec 12 14:13:16.029 PST

-------------------------------------------------------------------------------
0/0/CPU0
-------------------------------------------------------------------------------
Interface Delay-Measurement:
  Profile configuration:
    Measurement Type                       : Two-Way
    Probe computation interval             : 30 (effective: 30) seconds
    Type of services                       : Traffic Class: 6, DSCP: 48
    Burst interval                         : 3000 (effective: 3000) mSec
    Burst count                            : 10 packets
    Encap mode                             : UDP
    Payload Type                           : TWAMP-light
    Destination sweeping mode              : Disabled
    Periodic advertisement                 : Enabled
      Interval                             : 120 (effective: 120) sec
      Threshold                            : 10%
      Minimum-Change                       : 500 uSec
    Advertisement accelerated              : Disabled
    Threshold crossing check               : Minimum-delay


RP/0/0/CPU0:router# show performance-measurement summary detail location 0/2/CPU0

Thu Dec 12 14:09:59.162 PST

-------------------------------------------------------------------------------
0/2/CPU0
-------------------------------------------------------------------------------
Total interfaces                           : 1
Total SR Policies                          : 0
```

```
Total RSVP-TE tunnels                        : 0
Total Maximum PPS                            : 2000 pkts/sec
Total Interfaces PPS                         : 0 pkts/sec
Maximum Allowed Multi-hop PPS                : 2000 pkts/sec
Multi Hop Requested PPS                      : 0 pkts/sec (0% of max allowed)
Dampened Multi Hop Requested PPS             : 0% of max allowed
Inuse Burst Interval Adjustment Factor       : 100% of configuration


Interface Delay-Measurement:
  Total active sessions                      : 1
  Counters:
    Packets:
      Total sent                             : 26
      Total received                         : 26
    Errors:
        TX:
          Reason interface down              : 0
          Reason no MPLS caps                : 0
          Reason no IP address               : 0
          Reason other                       : 0
        RX:
          Reason negative delay              : 0
          Reason delay threshold exceeded    : 0
          Reason missing TX timestamp        : 0
          Reason missing RX timestamp        : 0
          Reason probe full                  : 0
          Reason probe not started           : 0
          Reason control code error          : 0
          Reason control code notif          : 0
    Probes:
      Total started                          : 3
      Total completed                        : 2
      Total incomplete                       : 0
      Total advertisements                   : 0

SR Policy Delay-Measurement:
  Total active sessions                      : 0
  Counters:
    Packets:
      Total sent                             : 0
      Total received                         : 0
    Errors:
        TX:
          Reason interface down              : 0
          Reason no MPLS caps                : 0
          Reason no IP address               : 0
          Reason other                       : 0
        RX:
          Reason negative delay              : 0
          Reason delay threshold exceeded    : 0
          Reason missing TX timestamp        : 0
          Reason missing RX timestamp        : 0
          Reason probe full                  : 0
          Reason probe not started           : 0
          Reason control code error          : 0
          Reason control code notif          : 0
    Probes:
      Total started                          : 0
      Total completed                        : 0
      Total incomplete                       : 0
      Total advertisements                   : 0

RSVP-TE Delay-Measurement:
```

```
           Total active sessions                     : 0
           Counters:
             Packets:
               Total sent                            : 0
               Total received                        : 0
             Errors:
                 TX:
                   Reason interface down             : 0
                   Reason no MPLS caps               : 0
                   Reason no IP address              : 0
                   Reason other                      : 0
                 RX:
                   Reason negative delay             : 0
                   Reason delay threshold exceeded   : 0
                   Reason missing TX timestamp       : 0
                   Reason missing RX timestamp       : 0
                   Reason probe full                 : 0
                   Reason probe not started          : 0
                   Reason control code error         : 0
                   Reason control code notif         : 0
             Probes:
               Total started                         : 0
               Total completed                       : 0
               Total incomplete                      : 0
               Total advertisements                  : 0

Global Delay Counters:
  Total packets sent                                 : 26
  Total query packets received                       : 26
  Total invalid session id                           : 0
  Total missing session                              : 0

RP/0/0/CPU0:router# show performance-measurement interfaces detail
Thu Dec 12 14:16:09.692 PST


--------------------------------------------------------------------------------
0/0/CPU0
--------------------------------------------------------------------------------


--------------------------------------------------------------------------------
0/2/CPU0
--------------------------------------------------------------------------------

Interface Name: GigabitEthernet0/2/0/0 (ifh: 0x1004060)
  Delay-Measurement                 : Enabled
  Loss-Measurement                  : Disabled
  Configured IPv4 Address           : 10.10.10.2
  Configured IPv6 Address           : 10:10:10::2
  Link Local IPv6 Address           : fe80::3a:6fff:fec9:cd6b
  Configured Next-hop Address        : Unknown
  Local MAC Address                 : 023a.6fc9.cd6b
  Next-hop MAC Address              : 0291.e460.6707
  Primary VLAN Tag                  : None
  Secondary VLAN Tag                : None
  State                             : Up

  Delay Measurement session:
    Session ID         : 1

    Last advertisement:
      Advertised at: Dec 12 2019 14:10:43.138 (326.782 seconds ago)
      Advertised reason: First advertisement
      Advertised delays (uSec): avg: 839, min: 587, max: 8209, variance: 297

    Next advertisement:
```

```
      Threshold check scheduled in 1 more probe (roughly every 120 seconds)
      Aggregated delays (uSec): avg: 751, min: 589, max: 905, variance: 112
      Rolling average (uSec): 756

  Current Probe:
    Started at Dec 12 2019 14:15:43.154 (26.766 seconds ago)
    Packets Sent: 9, received:9
    Measured delays (uSec): avg: 795, min: 631, max: 1199, variance: 164
    Next probe scheduled at Dec 12 2019 14:16:13.132 (in 3.212 seconds)
    Next burst packet will be sent in 0.212 seconds
    Burst packet sent every 3.0 seconds
    Probe samples:
      Packet Rx Timestamp       Measured Delay (nsec)
      Dec 12 2019 14:15:43.156          689223
      Dec 12 2019 14:15:46.156          876561
      Dec 12 2019 14:15:49.156          913548
      Dec 12 2019 14:15:52.157         1199620
      Dec 12 2019 14:15:55.156          794008
      Dec 12 2019 14:15:58.156          631437
      Dec 12 2019 14:16:01.157          656440
      Dec 12 2019 14:16:04.157          658267
      Dec 12 2019 14:16:07.157          736880
```

You can also use the following commands for verifying the PM for link delay on the local-end router.

Command	Description
show performance-measurement history probe interfaces [*interface*]	Displays the PM link-delay probe history for interfaces.
show performance-measurement history aggregated interfaces [*interface*]	Displays the PM link-delay aggregated history for interfaces.
show performance-measurement history advertisement interfaces [*interface*]	Displays the PM link-delay advertisement history for interfaces.
show performance-measurement counters [interface *interface*] [location *location-name*]	Displays the PM link-delay session counters.

You can also use the following commands for verifying the PM for link-delay configuration on the remote-end router.

Command	Description
show performance-measurement responder summary [**location** *location-name*]	Displays the PM for link-delay summary on the remote-end router (responder).
show performance-measurement responder interfaces [*interface*]	Displays PM for link-delay for interfaces on the remote-end router.
show performance-measurement responder counters [**interface** *interface*] [**location** *location-name*]	Displays the PM link-delay session counters on the remote-end router.

Delay Normalization

Performance measurement (PM) measures various link characteristics like packet loss and delay. Such characteristics can be used by IS-IS as a metric for Flexible Algorithm computation. Low latency routing using dynamic delay measurement is one of the primary use cases for Flexible Algorithm technology.

Delay is measured in microseconds. If delay values are taken as measured and used as link metrics during the IS-IS topology computation, some valid ECMP paths might be unused because of the negligible difference in the link delay.

The Delay Normalization feature computes a normalized delay value and uses the normalized value instead. This value is advertised and used as a metric during the Flexible Algorithm computation.

The normalization is performed when the delay is received from the delay measurement component. When the next value is received, it is normalized and compared to the previous saved normalized value. If the values are different, then the LSP generation is triggered.

The following formula is used to calculate the normalized value:

- **Dm** – measured Delay

- **Int** – configured normalized Interval

- **Off** – configured normalized Offset (must be less than the normalized interval Int)

- **Dn** – normalized Delay

- **a** = Dm / Int (rounded down)

- **b** = a * Int + Off

If the measured delay (Dm) is less than or equal to **b**, then the normalized delay (Dn) is equal to **b**. Otherwise, Dn is **b + Int**.

Example

The following example shows a low-latency service. The intent is to avoid high-latency links (1-6, 5-2). Links 1-2 and 5-6 are both low-latency links. The measured latency is not equal, but the difference is insignificant.
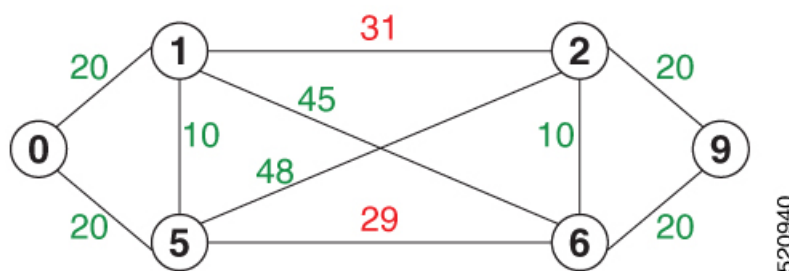
We can normalize the measured latency before it is advertised and used by IS-IS. Consider a scenario with the following:
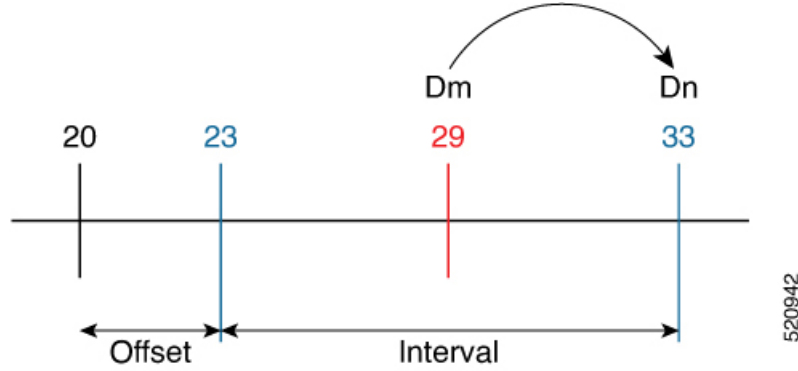
- Interval = 10

- Offset = 3

The measured delays will be normalized as follows:

- **Dm** = 29

$\mathbf{a} = 29 / 10 = 2$ (2.9, rounded down to 2)

$\mathbf{b} = 2 * 10 + 3 = 23$

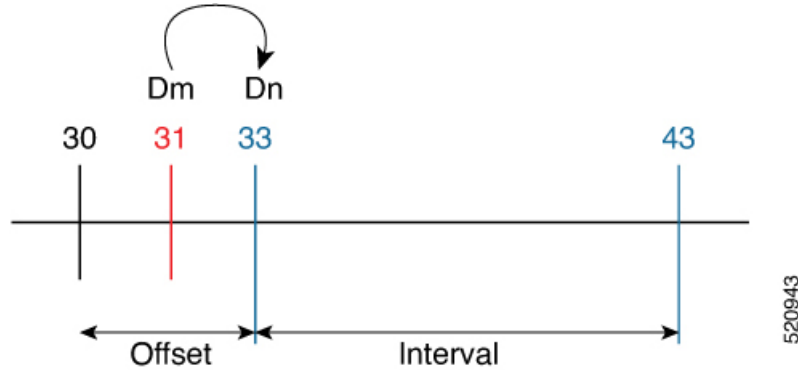In this case, **Dm** (29) is greater than **b** (23); so **Dn** is equal to **b+I** (23 + 10) = **33**

- **Dm** = 31

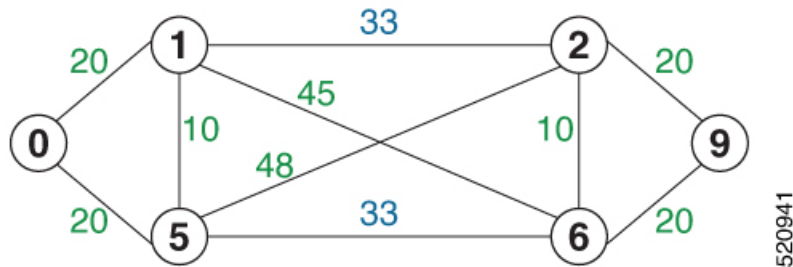 $\mathbf{a} = 31 / 10 = 3$ (3.1, rounded down to 3)

  $\mathbf{b} = 3 * 10 + 3 = 33$

  In this case, **Dm** (31) is less than **b** (33); so **Dn** is **b** = **33**

The link delay between 1-2 and 5-6 is normalized to 33.

Configuration

Delay normalization is disabled by default. To enable and configure delay normalization, use the **delay normalize interval** *interval* [**offset** *offset*] command.

• *interval* – The value of the normalize interval in microseconds.

• *offset* – The value of the normalized offset in microseconds. This valude must be smaller than the value of normalized interval.

IS-IS Configuration

```
router isis 1
 interface GigEth 0/0/0/0
  delay normalize interval 10 offset 3
  address-family ipv4 unicast
   metric 77
```

OSPF Configuration

```
router ospf 1
 area 0
  interface GigabitEthernet0/0/0/0
   delay normalize interval 10 offset 3
  !
 !
!
```

Delay Measurement for IP Endpoint

Table 3: Feature History Table

Feature Name	Release Information	Feature Description
IP Endpoint Delay Measurement Monitoring	Release 7.4.1	This feature measures the end-to-end delay and monitors liveness of a specified IP endpoint node, including VRF-aware (awareness of multiple customers belonging to different VRFs). This feature is supported on IPv4, IPv6, and MPLS data planes.

Delay for an IP endpoint is the amount of time it takes for a data packet to travel from a source device to a specific IP endpoint within a network.

To measure a delay for a packet, also called a probe, is sent from a source device to the target IP endpoint.

The time from when the packet leaves the source to when it arrives at the endpoint is measured and recorded as the delay.

You can measure one-way delay, Two-way delay, and Roundtrip delay or delay in loop-back mode. For more information on Delay measurement, see Link Delay Measurement and Measurement Modes.

Collecting IP Endpoint Probe Statistics

• Statistics associated with the probe for delay metrics are available via Histogram and Streaming Telemetry.

• Model Driven Telemetry (MDT) is supported for the following data:

- Summary, endpoint, session, and counter show command bags.

- History buffers data

- Model Driven Telemetry (MDT) and Event Driven Telemetry (EDT) are supported for the following data:

  - Delay metrics computed in the last probe computation-interval (event: probe-completed)

  - Delay metrics computed in the last aggregation-interval; that is, end of the periodic advertisement-interval (event: advertisement-interval expired)

  - Delay metrics last notified (event: notification-triggered)

- The following xpaths for MDT/EDT is supported:

  - `Cisco-IOS-XR-perf-meas-oper:performance-measurement/nodes/node/endpoints/endpoint-delay/endpoint-last-probes`

  - `Cisco-IOS-XR-perf-meas-oper:performance-measurement/nodes/node/endpoints/endpoint-delay/endpoint-last-aggregations`

  - `Cisco-IOS-XR-perf-meas-oper:performance-measurement/nodes/node/endpoints/endpoint-delay/endpoint-last-advertisements`

Supported Features

- IPv6 Endpoint Delay in Default VRF (over SRv6)

- SRv6 Endpoint Delay in Default VRF (Endpoint can be Node SID, Flex-Algo SID, Packed uSID carrier)

- IPv6 Endpoint Delay in VRF (static uDT6)

- IPv6 Endpoint Delay in VRF (dynamic uDT6 encap)

- IPv4 Endpoint Delay in VRF or GRT (static uDT4)

- IPv4 Endpoint Delay in VRF or GRT (dynamic uDT4 encap)

Guidelines and Limitations

You can specify a custom labeled path through one or more user-configured segment-lists. User-configured segment-list represents the forwarding path from sender to reflector when the probe is configured in delay-measurement mode.

- SR PM is supported on hardware that supports Precision Time Protocol (PTP). This requirement applies to both one-way and two-way delay measurement.

  See the "**Configuring Precision Time Protocol**" chapter in the *System Management Configuration Guide for Cisco 8000 Series Routers* for Restrictions for PTP and the Timing Hardware Support Matrix.

- Examples of the custom segment-list include:

  - Probe in delay-measurement mode with a segment-list that includes Flex-Algo prefix SID of the endpoint

- Probe in delay-measurement mode with a segment-list that includes a SID-list with labels to reach the endpoint or the sender (forward direction)

- Probe in delay-measurement mode with a segment-list that includes BSID associated with SR policy to reach the end point.

- Endpoint segment list configuration is not supported under nondefault VRF.

## IP Endpoint Liveness Detection in an SR MPLS Network

IP endpoint liveness detection leverages the loopback measurement-mode. The following workflow describes the sequence of events.

1. The sender creates and transmits the PM probe packets.

   The IP destination address (DA) on the probe packets is set to the loopback value of the sender itself.

   The transmit timestamp (T1) is added to the payload.

   The probe packet is encapsulated with the label corresponding to the endpoint.

2. The network delivers the PM probe packets following the LSP toward the endpoint.

3. The end-point receives the PM probe packets.

   Packets are forwarded back to the sender based on the forwarding entry associated with the IP DA of the PM probe packet. If an LSP exists, the probe packet is encapsulated with the label of the sender.

4. The sender node receives the PM probe packets.

   The received timestamp (T4) stored.

   If the sender node doesn't receive the specified number of probe packets (based on the configured multiplier), the sender node declares the PM session as down.

The following figure illustrates a liveness detection probe toward an IP endpoint learned by the IGP. The network interconnecting the sender and reflector provides MPLS connectivity with Segment Routing.

The liveness detection multiplier is set to 5 to specify the number of consecutive missed probe packets before the PM session is declared as down.

Figure 2: IP Endpoint Liveness Detection
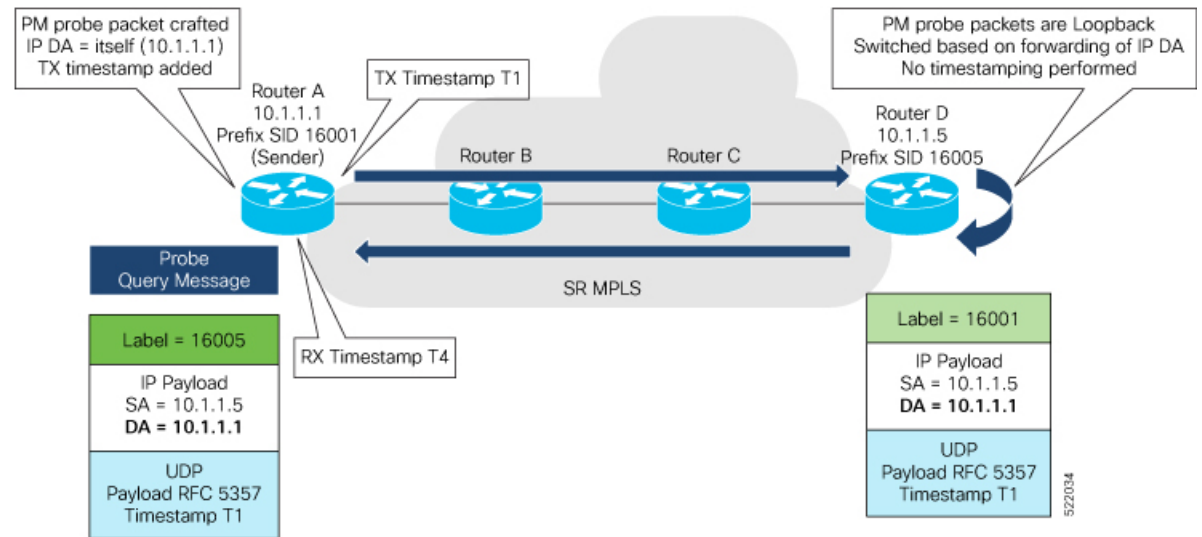
Configuration Example

```
RouterA(config)# performance-measurement
RouterA(config-perf-meas)# endpoint ipv4 1.1.1.5
RouterA(config-pm-ep)# source-address ipv4 1.1.1.1
RouterA(config-pm-ep)# liveness-detection
RouterA(config-pm-ep-ld)# exit
RouterA(config-pm-ep)# exit
RouterA(config-perf-meas)# liveness-profile endpoint default
RouterA(config-pm-ld-ep)# liveness-detection
RouterA(config-pm-ld-ep-ld)# multiplier 5
RouterA(config-pm-ld-ep-ld)# exit
RouterA(config-pm-ld-ep)# probe
RouterA(config-pm-ld-ep-probe)# measurement-mode loopback
```

Running Configuration

```
performance-measurement
 endpoint ipv4 1.1.1.5
  source-address ipv4 1.1.1.1
  liveness-detection
  !
 !
 liveness-profile endpoint default
  liveness-detection
   multiplier 5
  !
  probe
   measurement-mode loopback
  !
 !
!
end
```

Verification

```
RouterA# show performance-measurement endpoint ipv4 1.1.1.5
```

```
-------------------------------------------------------------------------------
0/RSP0/CPU0
-------------------------------------------------------------------------------

Endpoint name: IPv4-1.1.1.5-vrf-default
  Source address           : 1.1.1.1
  VRF name                 : default
  Liveness Detection       : Enabled
  Profile Keys:
    Profile name           : default
    Profile type           : Endpoint Liveness Detection

  Segment-list             : None
  Session State: Down
  Missed count: 0
```