IP SLA—Service Performance Testing

This module describes how to configure the ITU-T Y.1564 Ethernet service performance test methodology that measures the ability of a network device to enable movement of traffic at the configured data rate.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to https://cfnng.cisco.com/. An account on Cisco.com is not required.

Information About Service Performance Operations

Y.1564 is an Ethernet service activation test methodology and is the standard for turning up, installing, and troubleshooting Ethernet and IP based services. Y.1564 is the only standard test methodology that allows a complete validation of Ethernet service-level agreements (SLAs) in a single test.

Service activation testing (SAT) is designed to measure the ability of a Device Under Test (DUT) or a network under test to properly forward traffic in different states.

Effective with Cisco IOS XE Everest Release 16.5.1, 10 Gigabit (10G) SAT session is supported on Cisco RSP2 and Cisco RSP3 Modules. Any SAT session with a rate-step greater than or equal to 1 Gbps is considered as 10G SAT session.

Cisco implementation of ITU-T Y.1564 has three key objectives:

- To serve as a network SLA validation tool, ensuring that a service meets its guaranteed performance settings in a controlled test time.
- To ensure that all services carried by the network meet their SLA objectives at their maximum committed rate, thus proving that under maximum load, network devices and paths can support all traffic as designed.
- To perform medium-term and long-term service testing, confirming that network elements can properly carry all services while under stress during a soaking period.

The following Key Performance Indicators (KPI) metrics are collected to ensure that the configured SLAs are met for the service or stream. These are service acceptance criteria metrics.

- Information Rate (IR) or throughput—Measures the maximum rate at which none of the offered frames are dropped by the device under test (DUT). This measurement translates into the available bandwidth of the Ethernet virtual connection (EVC).
- Frame Transfer Delay (FTD) or latency—Measures the round-trip time (RTT) taken by a test frame to travel through a network device, or across the network and back to the test port.
- Frame Loss Ratio (FLR)—Measures the number of packets lost from the total number of packets sent. Frame loss can be due to a number of issues such as network congestion or errors during transmissions.
- Frame Delay Variation (FDV) or jitter—Measures the variations in the time delays between packet deliveries.

The below table presents the KPI support matrix for RSP3 Module:

Table 1: Supported Key Performance Indicators Matrix for Cisco RSP3 Module

KPI	ASIC-Based SADT		FPGA-Based SADT	
	Internal Direction	External Direction	Internal Direction	External Direction
Delay	N	N	Y	Y
Jitter	N	N	Y	Y
Loss	Y	Y	Y	Y
Throughput	Y	Y	Y	Y

Note We always recommend that you use FPGA-based SADT.

SADT Internal sessions do not support ASIC-based SAT.

Because they interconnect segments, forwarding devices (switches and routers) and network interface units are the basis of any network. If a service is not correctly configured on any one of these devices within the end-to-end path, network performance can be greatly affected, leading to potential service outages and network-wide issues such as congestion and link failures. Service performance testing is designed to measure the ability of DUT or network under test, to correctly forward traffic in different states. The Cisco implementation of ITU-T Y.1564 includes the following service performance tests:

- Minimum data rate to CIR—Bandwidth is generated from the minimum data rate to the committed information rate (CIR) for the test stream. KPI for Y.1564 are then measured to ensure that the configured service acceptance criteria (SAC) are met.
- CIR to EIR—Bandwidth is ramped up from the CIR to the excess information rate (EIR) for the test stream. Because EIR is not guaranteed, only the transfer rate is measured to ensure that CIR is the minimum bandwidth up to the maximum EIR. Other KPI is not measured.

Service performance supports four operational modes: two-way statistics collection, one-way statistics collection, passive measurement mode, and traffic generator mode. Statistics are calculated, collected, and reported to the IP SLAs module. The statistics database stores historical statistics pertaining to the operations that have been executed.

- One-way statistics collection—Both the passive measurement mode and the traffic generator mode are used in conjunction with each other. One device sends traffic as the generator and another device receives traffic in the passive mode and records the statistics. The passive mode is distinct from the two-way mode, where the remote device records statistics instead of looping back the traffic and the sending device records only the transmit statistics.
- Two-way statistics collection—All the measurements are collected by the sender. The remote target must be in the loopback mode for the two-way statistics to work. Loopback mode enables the traffic from the sender to reach the target and be returned to the sender.
- Passive measurement mode—This mode is enabled by excluding a configured traffic profile. A passive measurement operation does not generate live traffic. The operation collects only statistics for the target configured for the operation.
- Traffic generator mode—This mode records transmit statistics for the number of packets and bytes sent.

Prerequisites for IP SLA - Service Performance Testing

Ensure that the direction configured for the **measurement-type direction {internal | external}** and the **profile traffic direction {internal | external}** commands is the same.

Scale and Limitations for Configuring IP SLA - Service Performance Operation

The following tables shows the scaling numbers supported for different SAT sessions.

Table 2: Scaling Numbers for IP SLA on the Cisco ASR 900 RSP2 Module

IP SLA	1G Scaling Numbers Supported	10G Scaling Numbers Supported
IP Target Color Aware SLA	5	NA
IP Target Color Blind SLA	15	
Ethernet Target Color-Aware SLA	1	NA
Ethernet Target Color Blind SLA	8 (4 Internal SLA + 4 External SLA)	1
IP Target Loopback SLA	4	NA

Table 3: Scaling numbers for ASIC and FPGA based SAT on the Cisco ASR 900 RSP3 Module

IP SLA	ASIC Based SAT	FPGA Based SAT
Color-Blind Sessions	4	16
Color-Aware Sessions	Not supported	5

Note The scale limit with the combination of Color-Aware and Color Blind IP SLA depends on the number of TCAM entries that the combination of SAT sessions consume. The Color-Aware session takes 3 entries for each session and the Color Blind consumes 1 entry for each session. Hence, the maximum scale for Color-Aware sessions is 15 (3 * 5 = 15 entries) and that for the Color Blind sessions is 15 (15 * 1 = 15 entries). Combination of Color-Aware and Color Blind depends on the number of TCAM entries consumed by the SAT profile and it is limited to entries.

Note If a 10G SADT session is running then no other 1G or 10G session can be started on the Cisco ASR 900 RSP2 Module.

The following table lists the Y.1564 two-way throughput measurement.

Table 4: Throughput Measurement for Each Packet Size on the Cisco ASR 900 RSP2 Module

Packet Size (Bytes)	1G Max Rate (kbps)	10G Max Rate (kbps)
64	469848	4698480
128	638061	6380610
256	775123	7751230
512	867758	8677580
1024	922728	9227280
1280	934554	9345540
1518	942124	9421240
9216	977675	9776750
IMIX	788000	7880000

Table 5: Throughput Measurement for Each Packet Size for ASIC Based SAT on the Cisco ASR 900 RSP3 Module

Packet Size	Internal	External
Max Rate (kbps) rate:1G, IM:10G		
64	986169	925157
128	982719	975951
256	1018034	986169
512	1009204	988579
1024	1016314	997530
1280	1009846	1012763
1518	1014998	1039846
9216	1003852	1006002
Max Rate (kbps) rate:4G, IM:10G		
64	3822359	3604502
128	3884910	3893062
256	3938838	3960314
512	4080777	4010879
1024	4000000	4017306

Packet Size	Internal	External
1280	4123842	3981764
1518	4069995	4032446
9216	4004198	4075513
Max Rate (kbps) rate:8G, IM:10G		
64	5359118	7409427
128	5604487	7627530
256	5450054	8035130
512	5940545	8038857
1024	6048404	8118077
1280	6244374	8157713
9216	5632151	8182673
Max Rate (kbps) rate:10G, IM:10G		
64	5984087	7950793
128	6178049	8839840
256	6163375	9605736
512	6523558	9831282
1024	6836542	9797476
1280	6896587	10123292
9216	6798517	10250879

Table 6: Throughput Measurement for Each Packet Size for FPGA Based SAT on the Cisco ASR 900 RSP3 Module

Packet Size	Internal
Max Rate (Kbps): 1G	
64	999998 kbps
512	999998 kbps
1518	999996 kbps
Max Rate (Kbps): 5G	
64	4999990 kbps

Packet Size	Internal
512	4999990 kbps
1518	4999988 kbps
Max Rate (Kbps): 6.5G	
64	6499995 kbps
512	6499986 kbps
1518	6499997 kbps
Max Rate (Kbps): 10G	
64	6.9-7.2 Gbps
512	9554557 kbps
1518	9863795 kbps

Note For 10G SADT Traffic, for packet size 64, the throughput would be between 6.9-7.2Gbps, based on the router slots and the interface combination

Note The Max Rate mentioned in the tables above is the maximum SLA rate supported by router and it is independent of SLA sessions. Max Rate can be achieved in a single SLA session or combination of two or more SLA sessions. Exceeding the supported Max Rate might impact other services.

Restrictions for IP SLA - Service Performance Operation

- The IP SLA sender egress and ingress VLAN should match. Ensure to configure VLAN translation in the same context.
- IP SLA classification is supported only for the DSCP/TOS marking from IP SLA command.
- One-way statistics collection is not supported.
- Layer 2 Color-Aware IP SLA is not supported for external traffic direction.
- The bridge-domain target type is not supported for external traffic direction.
- Color-Aware SLA for bridge-domain target type is not supported.
- Since SAT traffic is intrusive, any other traffic is dropped for a particular EFP.
- IPv6 address is not supported as a destination address.
- For two-way mode, the Multicast destination support is not available for IP SLA (layer 3 SLA).

- IP SLA does not support enabling a signature.
- SLA on the target with Custom Ethertype encapsulation is not supported.
- SLA on the target with 802.1ad enabled is not supported.
- Multiple active sessions are not supported on the same Ethernet EFP.
- For operations with two-way measurements, any one of the parameters, namely, port, destination MAC address, and encapsulation VLANs, should be different for SLA sessions that are simultaneously active.
- Scaling is dependent on the availability of the terminal SAT session, terminal loopback session, and egress Span session.
- For layer 2 virtual forwarding instance (VFI) or Switched Virtual Interface (SVI), only target type EFP and generator or measurement type terminal sessions should be used.
- For IMIX traffic, packet sizes of 64 bytes, 512 bytes, and 1518 bytes are supported. These packet sizes are forwarded in the ratio 7:4:1.
- For operations with layer 2 and layer 3 SLA on Trunk EFP, outer VLAN tag of the packet is mandatory.
- While a SLA session is in progress, dynamic addition of MAC access lists (ACLs) does not affect the SLA traffic.
- Priority tag SLA in external direction is supported only when the inner tag and outer tag are marked as priority tags.
- Terminal and Facility SLA sessions cannot be started on a port configured as a SPAN destination.
- Source MAC address should not be configured as multicast or broadcast MAC address.
- PIM Sparse mode is not supported for traffic generator mode and passive mode.
- SAT session fails with proper syslog messages for the following reasons:
- Only interface or service instance is supported for external session.
- VLAN or Bridge-domain service types are not supported for facility Traffic Generator and Traffic Measurement.
- EFP or Trunk EFP or bridge-domain is shut.
- The following table shows the supported egress and ingress QOS on the sender side core interface for Ethernet and IP target SLA.

Table 7: IP SLA and Type of QOS supported

IP SLA	Type of QOS	Supported on sender side core interface
IP Target SLA	Egress	Yes
IP Target SLA	Ingress	No
Ethernet Target SLA	Egress	No
Ethernet Target SLA	Ingress	Yes

- The following table shows how Ethernet Target SLA with multicast or broadcast source MAC address is supported on different operational modes.

Table 8: Multicast or Broadcast MAC support criteria for SLA

Source or destination MAC address	Operational mode	Support for Ethernet Target SLA
Multicast or broadcast source MAC address	Traffic generator mode	Not supported
	Passive measurement mode	
	Two-way statistics collection mode	
Multicast or broadcast destination MAC address	Traffic generator mode	SLA generates the traffic
	Passive measurement mode	SLA receives the traffic
	Two-way statistics collection mode	Not supported

- Service Activation layer 3 Loopback is not supported with the target interface belonging to ASIC 1 in RSP2.
- Generation of burst traffic is not supported; therefore, configuration of CBS and EBS is not supported.
- IP SLAs configured with *start-time now* keyword need to be restarted after reload.
- PPS mode is *not* supported with IMIX packet size.
- IP SLA V2 (RFC 6812) and V3 are not supported on RSP3.
- For the color aware SADT to work as expected, rewrite EFP should be present.

Restrictions on the Cisco RSP2 Module

- SADT Internal sessions are not supported on ASIC interface on the RSP2 module.

  During interoperability of SADT with ME3600 and ASR920 routers, you experience a loss in ASR920 loopback with IMIX traffic. It is the expected behavior as the traffic is more bursty on ME3600.
- Only DSCP-based marking is supported for IP Target operations.
- The session duration is limited to multiples of 10; user input is rounded down to the nearest multiple of 10.
- Quality of Service (QOS) on any target type with IP SLA is not supported on layer 2 and layer 3 routers.
- Layer 3 IP SLA is not supported on external traffic direction.
- Layer 3 SLA Loopback is not supported for labelled incoming packets.
- For layer 3 Loopback, if the target type is service instance, the core and access side EFP should have the same encapsulation.

- For layer 3 Loopback, if the target type is VRF, only encapsulation untagged is supported. The loopback session is not supported for the VRF target types even for same encapsulation on access and core EFPs.
- For layer 3 Loopback, if the target type is bridge domain, only encapsulation untagged is supported. The loopback session is not supported for the bridge domain target types, even for the same encapsulation on access and core EFPs.
- For operations with passive measurement mode and target type EFP, the same destination MAC address cannot be used for any other traffic on a port as the loopback MAC Address Tables (CAM) tables contain the channel numbers and the destination MAC address. As a result, multiple SLAs with the same destination MAC address, on the same port active at the same time, are not supported for passive measurement mode.
- For operations with EFP using XConnect, only the target type EFP and terminal sessions for Tx and Rx statistics are supported.
- For layer 2 internal sessions with Rx statistics, either only four non-color-aware sessions, or one color-aware session and one non-color-aware session are supported.
- Port channel is not supported.
- For operations with SLA in PPS mode, an additional packet is forwarded.
- The minimum supported value for rate step is 1024 pps.
- While running SADT, the packet that matches the SLA profile source MAC, VLAN or untagged, is counted in the RX. For example, if you schedule an SLA and start PING in the same time frame, PING fails, since the ping acknowledgement packet is accounted in SLA RX packet. Similarly, the LL discovery packet from the responder is accounted in SLA RX. So, there is one extra packet and the same packet is not accounted in the LL discovery counter.

Restrictions for 10G SAT

- The IP SLA packets are generated and forwarded in ratio of 1:1:1:1:1 from UNI or NNI port based on your configuration.
- 10G service activation test (SAT) is supported only for Layer 2 traffic in external and internal direction.
- 10G SAT is not supported in internal direction for releases prior to 16.12.x.
- Only color blind configurations are supported. CIR, EIR, and other color aware parameters is not supported.
- 10G SAT can only run in two-way mode.
- Effective from Cisco IOS XE Gibraltar 16.12.1, Delay, and Jitter measurements are supported.
- 10G SAT target type that is supported is only on access EFP.
- A combination of 1G and 10G SAT sessions cannot be run in parallel.
- At SLA run time, SAT statistics may not match. Statistics must be validated only after SLA completes. While SAT SLA is running, there might be instances where Rx might be greater than Tx. This is because of slow retrieval of statistics from the hardware. Statistics should be verified only after SAT operation is complete.
- Layer 3 packets for Layer 2 facility SAT 10G session is not supported.

- Only Layer 2 related parameters (SRC, MAC, VLAN, COS) should be configured while constructing the packet profile.
- Ethertype of IPv4 or IPv6 is not supported.
- Layer 3 packet headers should not be used in profile packet.
- Multiple rate-steps that are mentioned in a single command can only be mentioned in incremental order.
- With 10G SAT running in external mode, while QoS egress shaper policy is applied on the same SAT interface, SAT traffic generation is being affected based on the shaper value. SAT rate-step is adjusted by shaper policy. However, when policer based policy is applied inbound, there is no impact with regards to SAT traffic being policed. Despite the policer value configured, no policing happens for the return traffic on SAT interface. This is due to the configured internal ACL to handle the SAT statistics.
- If a 10G SAT session is running (with a rate-step greater than or equal to 1 Gbps), a second 1G or 10G SAT session should not be executed parallely.
- The SAT rate-step upper limits should be defined in such a way that BFD has some bandwidth for itself and ensures that the OSPF flaps do not occur. The upper limit for FPGA traffic generation for SAT is same in both SAT 1G and 10G. So, the upper limit of SAT 1G x 10 are applicable for SAT 10G to avoid the OSPF flaps.
- OIR and SSO are not supported with SAT. SLA is to be stopped and re-started manually after these triggers.
- SADT session and Ethernet loopback (ELB) on the same service instance of an interface is not supported.
- 10G SAT with 802.1ad is not supported.
- A delay of 10 seconds is recommended between two 10G SAT iterations or between two SLA runs (serial run).
- A combination of untagged and default should never be configured on an interface for launching 10G SLA session. 10G SAT on encapsulation default does not work when encapsulation untagged is configured on the interface.
- Even with 10G SAT, maximum FPGA available for 920 is 1G. 10G SAT rate is achieved by generating the packets in FPGA (upto 1 Gbps) and multiplying it by 10 on the hardware. Hence, a maximum of 1G FPGA is only available for all processes including BFD, SAT, NetFlow, and so on So, crossing the 1G cumulative threshold in FPGA causes flaps on the various interfaces that involve FPGA.
- 10G SAT is not supported over VRF and Port-Channel interfaces.
- SADT 10G session uses a shadow session with given MAC + 1 (0011.1111.2222 to 0011.1111.2223).
- 10G SADT internal is supports only Xconnect EFP and Plain EFP.
- 10G SADT is not supported on L2VFI (Virtual Forwarding Interface) and local connect.
- 10G SADT Color-aware configurations are not supported.

Note

- Overall throughput in the system slightly varies up to +/- 2% from the mentioned rate-step value.
- Color-aware case "rewrite ingress tag pop 1 symmetric" is mandatory under the efp configuration.

Restrictions for SAT Two-Way Sessions on EFP Xconnect on the Cisco RSP2 Module

- For operations with EFP using XConnect, the rewrite ingress tag pop 1 symmetric command is not supported for two-way sessions when Class of Service (COS) value is a part of the packet profile.
- For operations with EFP using XConnect, the rewrite command is not supported when Class of Service (COS) value is configured for the SLA.
- For EVC with XConnect targets, CoS marking based on color for the color-aware cases is performed on the outer layer 2 header VLAN tags (if applicable). As a result, this marking should be retained across the network so that it is available on the packet, which is received at the remote end (passive measurement mode) or the same end after loopback at the remote end (two-way mode). If this CoS marking is not retained, there is no way identifying the color of the different packets and perform color-aware measurement.
- Color-aware two-way sessions measurement is not supported for the restrictions listed above.

Restrictions on Cisco RSP3 Module for ASIC-Based SAT

The following restrictions are applicable only on the Cisco RSP3 Module:

- The Tx and Rx counters are not synchronized during aggregation interval.
- Traffic generation and measurement on target Bridge-domain, layer 3 interfaces, MPLS PWs, and BDI are not supported.
- A maximum of four concurrent sessions are supported.
- Each session should run on a different bridge-domain with unique packet VLAN parameters.
- Color aware statistics are not supported.
- EFP port-channel is not supported.
- On target type EFP, bridge-domain specific features like L2PT, CEM, CFM, G.8032, STP, RSTP, and MSTP are not supported.
- Target type EFP should not have any ingress or egress QoS applied on it. No port level QoS should be present.
- Delay and jitter are not supported.
- IMIX packet type is not supported, if configured, it will generate 64 bytes of packets.
- Maximum traffic generation/measurement time is 11 hours.
- If SPAN is configured, there is double Rx counters in statistics for external mode and double Tx counters in statistics for internal mode.
- Traffic is not generated for priority tag (VLAN 0).
- On test EFP/interface Shutdown, the test packets do not egress out of any interface on the device, and after unshut, the traffic does not resume to egress. The test has to be restarted.
- Test on TEFP is not supported.
- Double tag packet with outer and inner COS and rewrite POP1 is not supported.

- Double tag packet with outer and inner COS and EFP with two VLAN and rewrite POP2 is not supported.
- Only half of the line-rate (interface rate) is supported on a two-way session in internal mode. This limitation is not applicable for passive measurement and generator only sessions.
- The service instance statistics on EFP, on which the internal session runs, has double the actual output packet count (synthetic packets are accounted twice.)
- For higher step rate (1G,10G) Tx and Rx counters may not be accurate. A maximum of 10 Gbps is supported.
- Configured step rate will not be the same as overall throughput, it varies based on the configured packet size.
- Tx and Rx bytes may not be the same in **show ip sla <> statistics** CLI, though Tx and Rx packet are same.
- There is no check if the destination MAC address is configured as all zero (0000.0000.0000) in IP SLA session.

Restrictions on Cisco RSP3 Module for FPGA Based SAT

The following restrictions ae applicable only on the Cisco RSP3 Module :

- For two-way sessions, source MAC address (last 2 bytes) of configured IP SLA sessions should be unique.
- For passive measurement sessions, destination MAC address (last 2 bytes) of configured IP SLA sessions should be unique.
- PPS may not match exactly.
- FPGA supports a minimum of 16 Kbps and a maximum of 10 Gbps. FPGA cannot generate traffic with 100 percent accuracy. There may be a little difference between configured bandwidth and actual bandwidth.
- For external direction SADT session, Rx and Tx packet count are same but Rx bytes and Tx bytes may not match exactly if the target EFP is configured with a rewrite action.
- In some scenarios, SLA statistics collection is delayed by 1 second. This may impact the overall throughput.
- Color aware statistics do not work if BDI is present for the bridge domain.
- Dynamic modification is not supported while the session is running.
- VLAN should be configured at the target interface in the SLA session. If the VLAN is not part of the interface configuration, packets are not handled properly.
- If the outer VLAN is not specified but the inner VLAN is specified for the target EFP, by default the outer VLAN is 4095, the outer COS is 7, and the CFI is 1. If both the outer and the inner VLAN is not specified, the VLAN tags are fetched from the EFP.
- The outer VLAN is required for the target TEFP.
- Color-aware SADT is not supported on Cisco RSP3-200 module and Cisco ASR 902 router.
- SADT supports only two rate three color policy.

- Starting with Cisco IOS XE Release 16.6.1, for Cisco ASR 907 routers, do *not* use any IM on slot 14 with FS or default mode. For Cisco ASR 903 routers, do *not* use 8X10 Gigabit interface module on slot 2 with SADT.

How to Configure IP SLA - Service Performance Testing

Y.1564 support on dot1ad Encapsulation

Table 9: Feature History

Feature Name	Release Information	Feature Description
Y.1564 support on dot1ad	Cisco IOS XE Cupertino 17.8.1	This feature enables Y.1564 Ethernet service activation test methodology support on interfaces that are configured with 802.1ad encapsulation. It allows you to perform medium-term and long-term service testing, confirming that the interfaces that are configured with 802.1ad can properly carry all services while under stress during a soaking period. The following commands are introduced: - **inner-eth-type** - **outer-eth-type**

Out-of-order Packet Counter on the Cisco RSP3 Module

Table 10: Feature History

Feature Name	Release Information	Feature Description
Out-of-order Packet Counter on the Cisco RSP3 Module	Cisco IOS XE 17.13.1	You can configure Out-of-order packet counter for FPGA-based SAT on the Cisco RSP3 module.

An Out-of-order packet counter is used in network protocols to detect and handle packets that arrive out of order, ensuring reliable data delivery over networks.

When data is transmitted over a network, it's divided into packets for efficient transmission. These packets can travel through different paths in the network and may arrive at the destination out of order. An Out-of-order packet counter keeps track of the sequence numbers of received packets and allows the receiver to reorder them correctly before delivering them to the application layer.

Note Out-of-order packet counter is only supported for FPGA-based SAT.

Configuring Out-of-order Packet Counter

Run the following command to configure the Out-of-order packet counter in the IP SLA session:

```
ip sla 1
    service-performance type ethernet dest-mac-addr 0010.0010.0010 interface
TenGigabitEthernet0/0/24 service instance 10
        measurement-type direction external
            out-of-order-packets
```

Verifying Out-of-order Packet Counter

Run the following command to verify if the out-of-order packet counter is enabled in the IP SLA session:

```
show running-config | sec ip sla 1
    service-performance type ethernet dest-mac-addr 0010.0010.0010 interface
TenGigabitEthernet0/0/24 service instance 10
        measurement-type direction external
            delay
            jitter
            out-of-order-packets
            loss
            receive
            throughput
        profile packet
            outer-cos 2
            outer-vlan 10
            packet-size 1024
            src-mac-addr 0020.0020.0020
            ethertype ipv4
            src-ip-addr 10.1.1.1
            dest-ip-addr 20.1.1.1
        profile traffic direction external
            rate-step kbps 30000
```

Example

Following is an example of the CLI output for SAT session with out-of-order packet counter configured. During the session, 10308227 out-of-order packets were detected, which accounts for approximately 6.46% of the total packets transmitted or received.

```
Router#sh ip sla statistics 102
IPSLAs Latest Operation Statistics

IPSLA operation id: 1031
Type of operation: Ethernet Service Performance
Test mode: Two-way Measurement
Steps Tested (kbps): 6000000
Test duration: 540 seconds

Latest measurement:  *11:47:49.305 IST Thu Oct 19 2023
Latest return code:  OK

Overall Throughput: In Progress

Step 1 (6000000 kbps):
Stats:
```

```
IR(kbps)  FL          FLR      Avail    FTD Min/Avg/Max      FDV Min/Avg/Max
5999407   0           0.00%    100.00%  12.40us/33.65us/37.92us  0ns/556ns/24.24us
Tx Packets: 159345228  Tx Bytes: 53300978766
Rx Packets: 159345228  Rx Bytes: 53300978766
Out of order Packets: 10308227/(6.46%    )
Step Duration: 71 seconds
```

Enabling FPGA-Based SAT on the Cisco RSP3 Module

Follow these steps to enable FPGA-based SAT :

Procedure

Step 1 **license feature service-offload enable**

Enables the FPGA license.

Step 2 **license feature service-offload bandwidth 10gbps npu-0** OR **license feature service-offload bandwidth 10gbps npu-1**

Enables the SAT FPGA mode.

- npu-0—Use for Cisco RSP3 Module .
- npu-1—Use for Cisco ASR 907 RSP3 Module.

Step 3 **write**

Writes the configuration to nvram before the reload.

Step 4 Reboot the router.

Disabling FPGA-Based SAT on the Cisco RSP3 Module

If the FPGA-based SAT is enabled, follow these steps to disable it:

Procedure

	Command or Action	Purpose
Step 1	**no license feature service-offload bandwidth 10gbps npu-0** OR **no license feature service-offload bandwidth 10gbps npu-1**	Disables the SAT FPGA mode. • npu-0—Use for Cisco RSP3 Module . • npu-1—Use for Cisco ASR 907 RSP3 Module.
Step 2	**no license feature service-offload enable**	Disables the FPGA license.
Step 3	**write**	Writes the configuration to nvram before the reload.

	Command or Action	Purpose
Step 4	Reboot the router.	

Configuring Ethernet Target Two-Way Color Blind Session

Perform the following steps to configure ethernet target color blind traffic generation.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ethernet dest-mac-addr** *dest-mac* { **service instance** | **bridge**} **Example:** `Device(config-ip-sla))#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/10 service instance 10`	Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format. Specifies the target for the SLA session. The options are: • service instance • bridge Only service instance is supported as target-type on 10G SAT on RSP2.
Step 5	**aggregation** | **default** | **description** | **duration** | **exit** | **frequency** | **no** | **profile** **Example:** `Device(config-ip-sla-service-performance)# duration time 60`	Specifies the type of service performance. The options are: • **aggregation** - Represents the statistics aggregation. • **default** - Sets a command to its defaults. • **description** - Describes the operation. • **duration** - Sets the service performance duration configuration. • **frequency** - Represents the scheduled frequency. The options available are

	Command or Action	Purpose
		iteration and time. The range in seconds is from 20 to 65535. • **profile** - Specifies the service performance profile. If you use the packet or traffic options, go to Step 9 or Step 12, respectively.
Step 6	**measurement-type direction** {**internal** | **external**} **Example:** `Device(config-ip-sla-service-performance)# measurement-type direction`	Specifies the statistics to measure traffic. The options available are external or internal; the default option is internal. Only external measurement-type direction is supported for 10G on RSP2.
Step 7	**default** | **exit** | **loss** | **no** | **throughput** | **receive** | **delay** | **jitter** **Example:** `Device(config-ip-sla-service-performance-measurement)# throughput`	Specifies the measurement type based on the service performance is calculated. The options are: • **default** - Sets a command to its defaults. • **loss** - Specifies the measurement, such as frame loss. • **throughput** - Specifies the measurement such as average rate of successful frame delivery. • **receive** - Specifies the passive measurement mode. • **delay** - Specifies the measurement that is frame delay (FTD). This is not supported on 10G on RSP2. • **jitter** - Specifies the measurement that is frame delay variation (FDV). This is not supported on 10G on RSP2.
Step 8	**exit**	Exits the measurement mode.
Step 9	**profile packet** **Example:** `Device(config-ip-sla-service-performance)#profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 10	**default** | **exit** | **inner-cos** | **inner-vlan** | **no** | **outer-cos** | **outer-vlan** | **packet-size** | **src-mac-addr** | **outer-eth-type** | **inner-eth-type** **Example:**	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **inner-cos** - Specifies the class of service (CoS) value for the inner VLAN tag of

	Command or Action	Purpose
	Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56	the interface from which the message will be sent. • **inner-vlan** - Specifies the VLAN ID for the inner vlan tag of the interface from which the message will be sent. • **outer-cos** - Specifies the CoS value that will be populated in the outer VLAN tag of the packet. • **outer-vlan** - Specifies the VLAN ID that will be populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size; the default size is 64 bytes. The supported packet sizes are 64 bytes,128 bytes, 256 bytes, 512 bytes, 1024 bytes, 1280 bytes, 1518 bytes, 9216 bytes, and IMIX. • **src-mac-addr** - Specifies the source MAC address in H.H.H format. • **outer-eth-type** - Specifies the encapsulation type for the outer VLAN tag of the packet as dot1ad or dot1q. • **inner-eth-type** - Specifies the encapsulation type for the inner VLAN tag of the interface from which the message is sent as dot1ad or dot1q. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session. **Note** If you do not specify the encapsulation type in the packet profile, `dot1q` is used by default.
Step 11	**exit** **Example:** Device(config-ip-sla-service-performance-packet)# exit	Exits the packet mode.
Step 12	**profile traffic direction {external | internal}** **Example:** Device(config-ip-sla-service-performance)#profile traffic direction external	Specifies the direction of the profile traffic. The options are external and internal. Only external profile traffic direction is supported for 10G on RSP2.

	Command or Action	Purpose
		Note This command is required to configure the **rate step kbps** command.
Step 13	**default** or **exit** or **no** or **rate step kbps | pps** **Example:** `Device(config-ip-sla-service-performance-traffic)#rate-step kbps 1000`	Specifies the traffic type. The options are: • **default** - Sets a command to its defaults. • **rate step kbps** - Specifies the transmission rate in kbps. The rate-step range is from 1-10000000 (1 Kbps to 10 Gbps). • **rate step pps** - Specifies the transmission rate in pps. The rate-step range is from 1-1000000 (1 to 1000000 pps). **Note** The command **rate-step kbps | pps number** is mandatory for traffic generation.
Step 14	**exit**	Exits the traffic mode.

Configuring Ethernet Target Color-Aware Traffic Generation

Perform the following steps to configure ethernet target color-aware traffic generation.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ethernet dest-mac-addr** *dest-mac-addr* {**bridge-domain** *domain_id* | **interface** *interface* [**service instance** *efp-id*]} **Example:**	Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format. Specifies the target for the SLA session. The option is:

	Command or Action	Purpose
	`Device(config-ip-sla))#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/0/10 service instance 10`	• service instance
Step 5	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iteration.
Step 6	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Specifies the time period to send packets.
Step 7	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 8	**default** | **exit** | **inner-cos** | **inner-vlan** | **no** | **outer-cos** | **outer-vlan** | **packet-size** | **src-mac-addr** | **outer-eth-type** | **inner-eth-type** **Example:** `Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56`	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **inner-cos** - Specifies the class of service (CoS) value for the inner VLAN tag of the interface from which the message is sent. • **inner-vlan** - Specifies the VLAN ID for the inner vlan tag of the interface from which the message is sent. • **outer-cos** - Specifies the CoS value that is populated in the outer VLAN tag of the packet. • **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. • **src-mac-addr** - Specifies the source MAC address in H.H.H format. • **outer-eth-type** - Specifies the encapsulation type for the outer VLAN tag of the packet as dot1ad or dot1q.

	Command or Action	Purpose
		• **inner-eth-type** - Specifies the encapsulation type for the inner VLAN tag of the interface from which the message is sent as dot1ad or dot1q. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session. **Note** If you do not specify the encapsulation type in the packet profile, `dot1q` is used by default.
Step 9	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the profile packet mode.

Step 10	**profile traffic direction** [**internal** | **external**] **cir** *number* or **eir** *number* or **cbs** *number* or **ebs** *number* or **conform-color set-cos-transmit** *cos_value* or **exceed-color set-cos-transmit** *cos_value* or **default** or **exit** or **no** or **rate step kbps | pps** *number*
	Example:
	`Device(config-ip-sla-service-performance)# profile traffic direction internal`
	`Device(config-ip-sla-service-performance-traffic)# cir 45000`
	`Device(config-ip-sla-service-performance-traffic)# eir 45000`
	`Device(config-ip-sla-service-performance-traffic)# conform-color set-cos-transmit 4`
	`Device(config-ip-sla-service-performance-traffic)# exceed-color set-cos-transmit 5`
	`Device(config-ip-sla-service-performance-traffic)# rate-step kbps 5000 9000`
		Defines an upper limit on the volume of the expected service frames belonging to a particular service instance. If a Traffic profile is not specified, the Service Performance probe is in passive measurement mode.
		• **cir** - Committed Information Rate.
		• **cbs** - Committed Burst Size.
		• **conform-color** - Sets the color conform.
		Note **coform-color** and **exceed-color** keywords are available only when **cir** or **eir** is configured.
		• **default** - Sets a command to its defaults.
		• **drop** - Drops the packet.
		• **eir** - Excess Information Rate.
		• **ebs** - Excess Burst Size.
		• **exceed-color** - Sets the color-exceed.
		• **exit** - Exits the traffic mode.
		• **no** - Negates a command or sets its defaults.
		• **set-cos-transmit** *cos_value* - Sets the CoS value to a new value and sends the packet. The valid range is from 0 to 7.

	Command or Action	Purpose
		• **transmit** - Sends the packet without altering it. This is the default value. • **default** - Sets a command to its defaults. • **rate step kbps** - Specifies the transmission rate in kbps. The rate-step range is from 1 to 1000000 (1 Kbps to 1 Gbps). • **rate step pps** - Specifies the transmission rate in pps. The rate-step range is from 1 to 1000000. **Note** The command **rate-step kbps | pps number** is mandatory for traffic generation.

Example

```
Device(config-ip-sla-service-performance)#profile packet
Device(config-ip-sla-service-performance-packet)#outer-vlan 100
Device(config-ip-sla-service-performance-packet)#outer-cos 5
Device(config-ip-sla-service-performance-packet)#exit
Device(config-ip-sla-service-performance)#profile traffic direction internal
Device(config-ip-sla-service-performance-traffi c)# cir 45000
Device(config-ip-sla-service-performance-traffi c)# eir 45000
Device(config-ip-sla-service-performance-traffic)# conform-color set-cos-transmit 4
Device(config-ip-sla-service-performance-traffic)# exceed-color set-cos-transmit 5
Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000
Device(config-ip-sla)# duration time 15
Device(config-ip-sla)# frequency iteration 4 delay 1
```

Configuring Ethernet Target Two-Way Color-Aware Session

Note Ethernet Target Two-Way Color-Aware Sessions are not supported on ASIC based Cisco RSP3 Module.

Perform the following steps to configure ethernet target two-way color-aware session.

Note The default **frequency iteration** command value may cause the duration command to be rejected for higher values. In this case, the **frequency iteration** command is recommended before the execution of **duration** command.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ethernet dest-mac-addr** *dest-mac-addr* |**interface** *interface* [**service instance** *efp-id*] **Example:** `Device(config-ip-sla))#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format. Specifies the target for the SLA session. The options are: • service instance • bridge
Step 5	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Specifies the time period to send packets.
Step 6	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated. It also defines the filter for incoming packets to be measured.
Step 7	**default** | **exit** | **inner-cos** | **inner-vlan** | **no** | **outer-cos** | **outer-vlan** | **packet-size** | **src-mac-addr** | **outer-eth-type** | **inner-eth-type** **Example:** `Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56`	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **inner-cos** - Specifies the class of service (CoS) value for the inner VLAN tag of the interface from which the message is sent. • **inner-vlan** - Specifies the VLAN ID for the inner vlan tag of the interface from which the message is sent. • **outer-cos** - Specifies the CoS value that is populated in the outer VLAN tag of the packet.

	Command or Action	Purpose
		• **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. • **src-mac-addr** - Specifies the source MAC address in H.H.H format. • **outer-eth-type** - Specifies the encapsulation type for the outer VLAN tag of the packet as dot1ad or dot1q. • **inner-eth-type** - Specifies the encapsulation type for the inner VLAN tag of the interface from which the message is sent as dot1ad or dot1q. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session. **Note** If you do not specify the encapsulation type in the packet profile, `dot1q` is used by default.
Step 8	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the profile packet mode.

Step 9	**profile traffic direction** [**internal** |**external**] **cir** *number* or **eir** *number* or **cbs** *number* or **ebs** *number* or **conform-color set-cos-transmit** *cos_value* or **exceed-color set-cos-transmit** *cos_value* or **default** or **exit** or **no** or **rate step kbps | pps** *number*
	Example:
	`Device(config-ip-sla-service-performance)# profile traffic direction internal`
	`Device(config-ip-sla-service-performance-traffic)# cir 45000`
	`Device(config-ip-sla-service-performance-traffic)# eir 45000`
	`Device(config-ip-sla-service-performance-traffic)# conform-color set-cos-transmit 4`
	`Device(config-ip-sla-service-performance-traffi`
		Specifies the in-line traffic profile or enables the selection of a preconfigured traffic profile. A traffic profile defines an upper limit on the volume of the expected service frames belonging to a particular service instance. If a Traffic profile is not specified, the Service Performance probe is in passive measurement mode.
		• **cir** - Committed Information Rate.
		• **cbs** - Committed Burst Size.
		• **conform-color** - Sets the color conform.
		• **default** - Sets a command to its defaults.

	Command or Action	Purpose

	`c)# exceed-color set-cos-transmit 5`
	`Device(config-ip-sla-service-performance-traffi`
	`c)# rate-step kbps 1000`
		• **drop** - Drops the packet.
		• **eir** - Excess Information Rate.
		• **ebs** - Excess Burst Size.
		• **exceed-color** - Sets the color-exceed.
		• **exit** - Exits the traffic mode.
		• **no** - Negates a command or sets its defaults.
		• **set-cos-transmit** *cos_value* - Sets the CoS value to a new value and sends the packet. The valid range is from 0 to 7.
		• **transmit** - Sends the packet without altering it. This is the default value.
		Note This command is required to configure the **rate step kbps** command.
		• **default** - Sets a command to its defaults.
		• **rate step kbps** - Specifies the transmission rate in kbps. The rate-step range is from 1 to 1000000 (1 Kbps to 1 Gbps).
		Note The command **rate-step kbps | pps number** is mandatory for traffic generation.

Step 10	**measurement-type direction** [**internal** |**external**] **conform-color cos** *cos_value* **exceed-color cos** *cos value* **Example:** `Device(config-ip-sla)# measurement-type direction internal cos 7`	Specifies the direction of measurement.
Step 11	**default** | **exit** | **loss** | **throughput** | **receive** | **delay** | **jitter** **Example:** `Device(config-ip-sla-service-performance-measurement)# throughput`	Specifies the measurement type based on which the service performance is calculated. The options are: • **default**: Sets a command to its defaults. • **loss**: Specifies the measurement such as frame loss.

	Command or Action	Purpose
		• **throughput**: Specifies the measurement such as average rate of successful frame delivery. • **receive**: Specifies the passive measurement mode. • **delay** - Specifies the measurement that is frame delay (FTD). • **jitter** - Specifies the measurement that is frame delay variation (FDV).
Step 12	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iterations.

Example

```
ip sla 3
service-performance type ether des
0033.3333.3333 interface gig 0/0/3
service instance 1
profile packet
outer-vlan 100
outer-cos 5
packet-size 128
ethertype ipv4
exit
profile traffic direction internal
cir 45000
eir 45000
cbs 45000
ebs 45000
conform-color set-cos-transmit 7
exceed-color set-cos-transmit 5
rate-step kbps 30000 45000 65000
90000
exit
measurement-type direction internal
conform-color cos 7
exceed-color cos 5
receive
throughput
loss
delay
jitter
duration time 20
frequency iteration 1 delay 2
```

Configuring Ethernet Target Passive Color-Aware Measurement

Note Ethernet Target Passive Color-Aware Sessions are not supported on ASIC based Cisco RSP3 Module.

Perform the following steps to configure ethernet target passive color-aware measurement.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ethernet dest-mac-addr** *dest_mac_addr* {**bridge-domain** *domain_id* | **interface** *interface* [**service instance** *efp-id*]} **Example:** `Device(config-ip-sla))#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format. Specifies the target for the SLA session. The options are: • service instance • bridge
Step 5	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Specifies the time period to send packets.
Step 6	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the filter for incoming packets to be measured.
Step 7	**default** | **exit** | **inner-cos** | **inner-vlan** | **no** | **outer-cos** | **outer-vlan** | **packet-size** | **src-mac-addr** | **outer-eth-type** | **inner-eth-type** **Example:**	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **inner-cos** - Specifies the class of service (CoS) value for the inner VLAN tag of

	Command or Action	Purpose
	`Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56`	the interface from which the message is sent. • **inner-vlan** - Specifies the VLAN ID for the inner vlan tag of the interface from which the message is sent. • **outer-cos** - Specifies the CoS value that is populated in the outer VLAN tag of the packet. • **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. • **src-mac-addr** - Specifies the source MAC address in H.H.H format. • **outer-eth-type** - Specifies the encapsulation type for the outer VLAN tag of the packet as dot1ad or dot1q. • **inner-eth-type** - Specifies the encapsulation type for the inner VLAN tag of the interface from which the message is sent as dot1ad or dot1q. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session. **Note** If you do not specify the encapsulation type in the packet profile, `dot1q` is used by default.
Step 8	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the profile packet mode.
Step 9	**measurement-type direction** [**internal** |**external**] **conforn-color cos** *cos_value* **exceed-color cos** *cos_value* **Example:**	Specifies the direction of measurement.

	Command or Action	Purpose
	`Device(config-ip-sla)# measurement-type direction internal cos 7`	
Step 10	**default** | **exit** | **loss** | **throughput** | **receive** **Example:** `Device(config-ip-sla-service-performance-measurement)# throughput`	Specifies the measurement type based on which the service performance is calculated. The options are: • **default** - Sets a command to its defaults. • **loss** - Specifies the measurement such as frame loss. • **throughput** - Specifies the measurement such as average rate of successful frame delivery. • **receive** - Specifies the passive measurement mode.
Step 11	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iterations.

Example

```
ip sla 3
service-performance type ether des
0033.3333.3333 interface gig 0/0/3
service instance 1
profile packet
outer-vlan 100
outer-cos 5
packet-size 128
ethertype ipv4
exit
measure direction internal
conform-color cos 7
exceed-color cos 5
receive
throughput
loss
duration time 20
frequency iteration 1 delay 2
```

Configuring Ethernet Target for Color-Aware Traffic Generation with IMIX

Note Ethernet Target for Color-Aware Traffic Generation with IMIX is not supported on ASIC based Cisco RSP3 Module.

Perform the following steps to configure ethernet target for color-aware traffic generation with IMIX.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ethernet dest-mac-addr** *dest_mac_addr* {**bridge-domain** *domain_id* | **interface** *interface* [**service instance** *efp-id*]} **Example:** `Device(config-ip-sla))#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format. Specifies the target for the SLA session. The options are: • service instance • bridge
Step 5	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Specifies the time period to send packets.
Step 6	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 7	**default** | **exit** | **inner-cos** | **inner-vlan** | **no** | **outer-cos** | **outer-vlan** | **packet-size imix** | **src-mac-addr** | **outer-eth-type** | **inner-eth-type** **Example:** `Device(config-ip-sla-service-performance-packet)#packet-size imix`	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **inner-cos** - Specifies the class of service (CoS) value for the inner VLAN tag of the interface from which the message is sent. • **inner-vlan** - Specifies the VLAN ID for the inner vlan tag of the interface from which the message is sent.

	Command or Action	Purpose
		• **outer-cos** - Specifies the CoS value that is populated in the outer VLAN tag of the packet. • **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. • **src-mac-addr** - Specifies the source MAC address in H.H.H format. • **outer-eth-type** - Specifies the encapsulation type for the outer VLAN tag of the packet as dot1ad or dot1q. • **inner-eth-type** - Specifies the encapsulation type for the inner VLAN tag of the interface from which the message is sent as dot1ad or dot1q. **Note** For IMIX, the packet-size should be explicitly mentioned as IMIX. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session. **Note** If you do not specify the encapsulation type in the packet profile, `dot1q` is used by default.
Step 8	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the profile packet mode.
Step 9	**profile packet direction** [**internal** | **external**] **cir** *number* or **eir** *number* or **cbs** *number* or **ebs** *number* or **conform-color set-cos-transmit** *cos_value* or **exceed-color set-cos-transmit** *cos_value* or **default** or **exit** or **no** or **rate step kbps** **Example:**	Specifies the in-line traffic profile or enables the selection of a pre-configured traffic profile. A traffic profile defines an upper limit on the volume of the expected service frames belonging to a particular service instance. If a traffic profile is not specified, the Service Performance probe is in passive measurement mode.

	Command or Action	Purpose
	Device(config-ip-sla-service-performance)# profile traffic direction internal Device(config-ip-sla-service-performance-traffic)# cir 45000 Device(config-ip-sla-service-performance-traffic)# eir 45000 Device(config-ip-sla-service-performance-traffic)# cbs 45000 Device(config-ip-sla-service-performance-traffic)# ebs 45000 Device(config-ip-sla-service-performance-traffic)# conform-color set-cos-transmit 4 Device(config-ip-sla-service-performance-traffic)# exceed-color set-cos-transmit 5 Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000	• **cir** - It is the Committed Information Rate. • **cbs** - It is the Committed Burst Size. • **conform-color** - Sets the conform color. • **default** - Sets a command to its defaults. • **drop** - Drops the packet. • **eir** - It is the Excess Information rate. • **ebs** - It is the Excess Burst Size. • **exceed-color** - Sets the exceed color. • **exit** - Exits the traffic mode. • **no** - Negates a command or sets its defaults. • **rate step kbps** - Sets the rate step. • **set-cos-transmit** *cos_value* - Sets the CoS value to a new value, and sends the packet. The valid range is from 0 to 7. • **transmit** - Sends the packet without altering it. This is the default value. • **default** - Sets a command to its defaults. **Note** This command is required to configure the **rate step kbps** command.
Step 10	**frequency iteration** *number* **delay** *number* **Example:** Device(config-ip-sla)# frequency iteration 1 delay 2	Specifies the number of interactions and delay between the iterations.

Example

```
ip sla 3
service-performance type ether des 0033.3333.3333 interface gig 0/0/3
service instance 1
profile packet
outer-vlan 100
outer-cos 5
packet-size mix
ethertype ipv4
exit
profile traffic direction internal
cir 45000
```

```
eir 45000
cbs 45000
ebs 45000
conform-color set-cos-transmit 7
exceed-color set-cos-transmit 5
rate-step kbps 30000 45000 65000
90000
exit
duration time 20
frequency iteration 1 delay 2
```

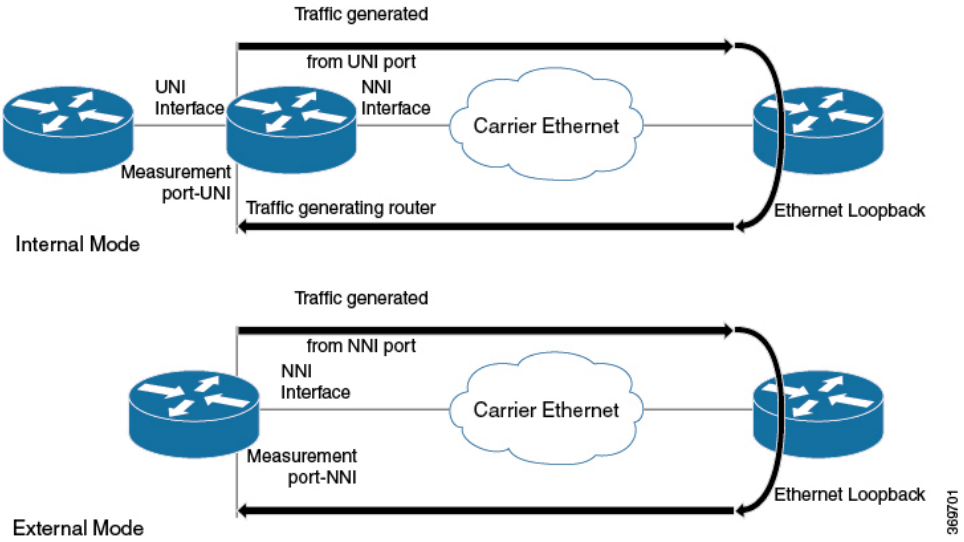
Information About Configuring Y.1564 to Generate and Measure Ethernet Traffic

Y.1564 is an ethernet service activation or performance test methodology for turning up, installing, and troubleshooting ethernet and IP based services. This test methodology allows for complete validation of ethernet service-level agreements (SLAs) in a single test. Using the traffic generator performance profile, you can create the traffic based on your requirements. Network performance indicators like throughput, loss, and availability are analyzed using layer 2 traffic with various bandwidth profiles. Availability is inversely proportional to frame loss ratio.

The figure below shows the Traffic Generator topology describing the traffic flow in the external and internal modes. The traffic is generated at the wire-side of Network-to-Network Interface (NNI) and is transmitted to the responder through the same interface for the external mode. The traffic is generated at the User-to-Network Interface (UNI) and transmitted to the responder through NNI respectively for the internal mode. The external mode is used to measure the throughput and loss at the NNI port whereas internal mode is used to measure the throughput and loss at the UNI port. During traffic generation, traffic at other ports is not affected by the generated traffic and can continue to switch network traffic.

Effective from the Cisco IOS XE 16.12.x release, 10G SAT External is supported on the Cisco Router.

Figure 1: Traffic Generator Topology



SAT is supported on main interface and EFPs. Layer 3 mode is not supported due to chip limitation. Also running SAT for specific bridge-domain is not supported.

The following table provides details of the different service types and traffic directions supported for each service typeon the Cisco ASR 900 RSP2 Module.

Table 11: Service Types and Their Corresponding Traffic Direction for IP Target SLA on the Cisco ASR 900 RSP2 Module

Service Type	Traffic Direction for IP Target SLA
Service Instance	Internal
Interface (Physical)	Internal
Bridge Domain	Internal
VRF	Internal

Table 12: Service Types and Their Corresponding Traffic Direction for Ethernet Target SLA on the Cisco ASR 900 RSP2 Module

Service Type	Traffic Direction for Ethernet Target SLA
Service Instance	Internal and External
Bridge Domain	Internal

The following table provides details of the different service types and traffic directions supported for each service type on the RSP3 module.

Table 13: Service Types and Their Corresponding Traffic Direction on the Cisco RSP3 Module

Target	ASIC based SAT		FPGA based SAT	
	Internal Direction	External Direction	Internal Direction	External Direction
L2 Interface (color-blind)	N	N	Y	Y
L2 Interface (color-aware)	N	N	Y	N
L2 EFP (color-blind)	Y	Y	Y	Y
L2 EFP (color-aware)	N	N	Y	N
L2 TEFP (color-blind)	N	N	Y	Y
L2 TEFP (color-aware)	N	N	Y	N
L2 VLAN/Bridge-domain (color-blind)	N	N	Y	N

Target	ASIC based SAT		FPGA based SAT	
	Internal Direction	External Direction	Internal Direction	External Direction
L2 VLAN/Bridge-domain (color-aware)	N	N	N	N
L2 PW (color-blind)	Y	N	Y	N
L2 PW (color-aware)	N	N	Y	N
L3 Routed Interface	N	N	N	N
L3 EFP/TEFP	N	N	N	N
L3 VRF	N	N	N	N
L3 PW	N	N	N	N
L3 Loopback	N	N	N	N

How to Configure Y.1564 to Generate and Measure IP Traffic

This section shows how to configure Y.1564 to generate and measure IP traffic.

Note This feature is not supported on both ASIC and FPGA based Cisco RSP3 Module.

Effective Cisco IOS XE Release 3.16, the following features are supported on the routers:

- IP flow parameters (DA/SA) Generation
- IP flow parameters (DA/SA) Measurement
- Color-Blind IP flow Generation and Measurement
- Color-Aware IP flow Generation: Differentiated services code point (DSCP) based
- Color-Aware IP flow Measurement: DSCP based
- IMIX Traffic Generation type (combination of 64, 512, and 1518 byte packets)

Note For vrf targets, the vrf-id specified in the SLA configuration should be the VRF Id derived from the output of the show vrf detail | include VRF Id STR

```
#sh vrf det | i VRF Id
VRF Mgmt-intf (VRF Id = 1); default RD <not set>; default VPNID <not set>
VRF SAT (VRF Id = 2); default RD 100:1; default VPNID <not set>
```

Configuring IP Target Color-Aware Traffic Generation

Perform the following steps to configure IP target color-aware traffic generation.

Note The **default frequency iteration** command value may cause the duration command to be rejected for higher values. In this case, the **frequency iteration** command is recommended before the execution of the **duration** command.

Note Configuring **source-ip-addr** is mandatory for layer 3 IP SLA.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ip dest-ip-addr** *dest-ip-addr* {**interface** *interface* | **interface** *interface* [**service instance** *efp-id* | **vrf** *vrf_id*} **Example:** `Device(config-ip-sla))# service-performance type ip dest-ip-addr 194.168.1.1 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as IP and the destination IP address. Specifies the target for the SLA session. The options are: • service instance • interface • vrf
Step 5	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iteration.
Step 6	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Specifies the time period to send packets.

	Command or Action	Purpose
Step 7	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 8	**default** | **exit** | **no** | **outer-vlan** | **packet-size** | **source-ip-addr** **Example:** `Device(config-ip-sla-service-performance-packet)#src-ip-addr 193.168.1.1`	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **exit** - Exists the packet mode. • **no** - Negates a command or sets its defaults. • **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. • **src-ip-addr** - Specifies the source IP address. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session.
Step 9	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the IP SLA Service Performance packet mode.

Step 10	**profile traffic direction** [**internal**] **cir** *number* or **eir** *number* or **cbs** *number* or **ebs** *number* or **conform-color set-dscp-transmit** *dscp_value* or **exceed-color set-dscp-transmit** *dscp_value* or **default** or **exit** or **no** or **rate step kbps | pps** *number*
	Example:
	`Device(config-ip-sla-service-performance)# profile traffic direction internal`
	`Device(config-ip-sla-service-performance-traffic)# cir 45000`
	`Device(config-ip-sla-service-performance-traffic)# eir 45000`
	`Device(config-ip-sla-service-performance-traffic)# conform-color set-dscp-transmit af43`
	`Device(config-ip-sla-service-performance-traffi`
		Specifies the in-line traffic profile or selection of a pre-configured traffic profile. A traffic profile defines an upper bound on the volume of the expected service frames belonging to a particular service instance. If a traffic profile is not specified, the Service Performance probe is in passive measurement mode.
		• **cir** - It is the Committed Information Rate.
		• **cbs** - It is the Committed Burst Size.
		• **conform-color** - Sets the color conform.
		• **default** - Sets a command to its defaults.

	Command or Action	Purpose
	c)# exceed-color set-dscp-transmit af41 Device(config-ip-sla-service-performance-traffi c)# rate-step kbps 1000	• **drop** - Drops the packet. • **eir** - It is Excess Information Rate. • **ebs** - It is the Excess Burst Size. • **exceed-color** - Sets the color-exceed. • **exit** - Exits the traffic mode. • **no** - Negates a command or sets its defaults. • **rate step kbps** - Sets the rate step. • **set-dscp-transmit** *dscp_value* - Sets the IP DSCP value to a new value and sends the packet. The valid range is from 0 to 63. You also can enter nemonic name for a commonly used value. • **transmit** - Sends the packet without altering it. This is the default value. **Note** This command is required to configure the **rate step kbps** command. • **default** - Sets a command to its defaults. • **rate step kbps** - Specifies the transmission rate in kbps. The rate-step range is from 1 to 1000000 (1 Kbps to 1 Gbps). • **rate step pps** - Specifies the transmission rate in pps. The rate-step range is from 1 to 1000000 (1 pps to 1000000 pps). **Note** The **rate-step kbps | pps number** is mandatory for traffic generation to happen.

Example

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 vrf 2
frequency iteration 1 delay 1
duration time 50
profile packet
source-ip-addr 193.168.1.1
packet-size 512
profile traffic direction internal
cir 45000
```

```
eir 45000
cbs 45000
ebs 45000
rate-step kbps 50000 90000
conform-color set-dscp-transmit af43
exceed-color set-dscp-transmit af41
```

Configuring IP Target Color Blind Traffic Generation

Perform the following steps to configure IP target color blind traffic generation.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ip dest-ip-addr** *dest-ip-addr* {**interface** *interface* | **bridge domain** *domain_id* | **interface** *interface* [**service instance** *efp-id* | **vrf** *vrf_id*} **Example:** `Device(config-ip-sla)# service-performance type ip dest-ip-addr 194.168.1.1 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as IP and the destination IP address. Specifies the target for the SLA session. The options are: • service instance • interface • vrf • bridge domain
Step 5	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iteration.
Step 6	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Sets the service performance duration configuration.

	Command or Action	Purpose
Step 7	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 8	**default** | **exit** | **no** | **outer-vlan** | **packet-size** | **source-ip-addr** **Example:** `Device(config-ip-sla-service-performance-packet)#src-ip-addr 193.168.1.1`	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **exit** - Exists the packet mode. • **no** - Negates a command or sets its defaults. • **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. • **src-ip-addr** - Specifies the source IP address. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session.
Step 9	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the IP SLA Service Performance packet mode.
Step 10	**profile traffic direction internal** **Example:** `Device(config-ip-sla-service-performance)# profile traffic direction internal`	Specifies the in-line traffic profile or selection of a pre-configured traffic profile. A traffic profile defines an upper bound on the volume of the expected service frames belonging to a particular service instance. If a traffic profile is not specified, the Service Performance probe is in passive measurement mode.
Step 11	**default** or **exit** or **no** or **rate step kbps | pps** **Example:** `Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000`	Specifies the traffic type. The options are: • **default** - Sets a command to its defaults. • **rate step kbps** - Specifies the transmission rate in kbps. The rate-step range is from 1 to 1000000 (1 Kbps to 1 Gbps).

	Command or Action	Purpose
		• **rate step pps** - Specifies the transmission rate in pps. The rate-step range is from 1 to 1000000 (1 pps to 1000000 pps). **Note** The command **rate-step kbps | pps number** is mandatory for traffic generation.

Example

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 vrf 2
frequency iteration 1 delay 1
duration time 50
profile packet
source-ip-addr 193.168.1.1
packet-size 512
profile traffic direction internal
rate-step kbps 50000 90000
```

Configuring IP Target Color Blind Passive Measurement

Perform the following steps to configure IP target color blind passive measurement.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ip dest-ip-addr** *dest_ip_addr* {**interface** *interface* | **bridge domain** *domain_id* | **interface** *interface* [**service instance** *efp-id*] | **vrf** *vrf_id*} **Example:**	Specifies the service performance type as IP and the destination IP address. Specifies the target for the SLA session. The options are: • service instance

	Command or Action	Purpose
	`Device(config-ip-sla)# service-performance type ip dest-ip-addr 194.168.1.1 interface gigabitEthernet0/0/10 service instance 10`	• interface • vrf • bridge domain
Step 5	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iteration.
Step 6	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Sets the service performance duration configuration.
Step 7	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 8	**default** | **exit** | **no** | **packet-size** | **source-ip-addr** **Example:** `Device(config-ip-sla-service-performance-measurement)# throughput`	Specifies the measurement type based on which the service performance is calculated. The options are: • **default** - Sets a command to its default values. • **exit** - Exists the packet mode. • **no** - Negates a command or sets its defaults. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, and 9216 bytes. • **source-ip-addr** - Specifies the source IP address.
Step 9	**measurement-type direction internal** **Example:** `config-ip-sla-service-performance)#measurement-type direction internal`	Specifies the direction of measurement.
Step 10	**default** | **exit** | **loss** | **throughput** | **receive** **Example:** `Device(config-ip-sla-service-performance-measurement)# throughput`	Specifies the measurement type based on which the service performance is calculated. The options are: • **default** - Sets a command to its default values.

	Command or Action	Purpose
		• **loss** - Specifies the measurement such as frame loss. • **throughput** - Specifies the measurement such as average rate of successful frame delivery. • **receive** - Specifies the passive measurement mode.

Example

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 vrf 2
frequency iteration 1 delay 1
duration time 50
measurement-type direction internal
receive
profile packet
source-ip-addr 193.168.1.1
packet-size 512
```

Configuring IP Target Two-Way Color-Aware Session

Perform the following steps to configure IP target two-way color-aware session.

Note The default **frequency iteration** command value may cause the **duration** command to be rejected for higher values. In this case, the **frequency iteration** command is recommended before the execution of the **duration** command.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.

	Command or Action	Purpose
Step 4	**service-performance type ip dest-ip-addr** *dest-ip-addr* {**interface** *interface* | **interface** *interface* [**service instance** *efp-id* | **vrf** *vrf_id*} **Example:** `Device(config-ip-sla)# service-performance type ip dest-ip 194.168.1.1 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as IP and the destination IP address. Specifies the target for the SLA session. The options are: • service instance • interface • vrf
Step 5	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iteration.
Step 6	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Sets the service performance duration configuration.
Step 7	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 8	**deafult** | **exit** | **no** | **outer vlan** | **packet-size** | **source-ip-addr** **Example:** `Device(config-ip-sla-service-performance-packet)# src-ip-addr 193.168.1.1`	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **exit** - Exists the packet mode. • **no** - Negates a command or set its defaults. • **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64, 128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. • **source-ip-addr** - Specifies the source IP address. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session.

	Command or Action	Purpose
Step 9	**exit** **Example:** `Device(config-ip-sla)# exit`	Exists the IP SLA Service Performance packet mode.

Step 10	**profile traffic direction internal cir** *number* or **eir** *number* or **cbs** *number* or **ebs** *number* or **conform-color set-dscp-transmit** *dscp_value* or **exceed-color set-dscp-transmit** *dscp_value* or **default** or **exit** or **no** or **rate step kbps | pps** *number*
	Example:
	`Device(config-ip-sla-service-performance)# profile traffic direction internal`
	`Device(config-ip-sla-service-performance-traffic)# cir 45000`
	`Device(config-ip-sla-service-performance-traffic)# eir 45000`
	`Device(config-ip-sla-service-performance-traffic)# conform-color set-dscp-transmit af434`
	`Device(config-ip-sla-service-performance-traffic)# exceed-color set-dscp-transmit af41`
	`Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000`
		Specifies the in-line traffic profile or selection of a pre-configured traffic profile. A traffic profile defines an upper bound on the volume of the expected service frames belonging to a particular service instance. If a traffic profile is not specified, the Service Performance probe is in passive measurement mode.
		• **cir** - It is the Committed Information Rate.
		• **cbs** - It is the Committed Burst Size.
		• **conform-color** - Sets the color conform.
		• **default** - Sets a command to its defaults.
		• **drop** - Drops the packet.
		• **eir** - It is Excess Information Rate.
		• **ebs** - It is the Excess Burst Size.
		• **exceed-color** - Sets the color-exceed.
		• **exit** - Exits the traffic mode.
		• **no** - Negates a command or sets its defaults.
		• **rate step kbps** - Sets the rate step.
		• **set-dscp-transmit** *dscp_value* - Sets the IP DSCP value to a new value and sends the packet. The valid range is from 0 to 63. You also can enter nemonic name for a commonly used value.
		• **transmit** - Sends the packet without altering it. This is the default value.
		Note This command is required to configure the **rate step kbps** command.
		• **default** - Sets a command to its defaults.
		• **rate step kbps** - Specifies the transmission rate in kbps. The rate-step range is from 1 to 1000000 (1 Kbps to 1 Gbps).

	Command or Action	Purpose
		• **rate step pps** - Specifies the transmission rate in pps. The rate-step range is from 1 to 1000000 (1 pps to 1000000 pps). **Note** The **rate-step kbps | pps number** is mandatory for traffic generation.
Step 11	**measurement-type direction internal conform-color dscp** *dscp_value* **exceed-color dscp** *dscp_value* **Example:** `Device(config-ip-sla-service-performance)# measurement-type direction internal conform-color dscp af43 exceed-color dscp af41`	Specifies the direction of measurement.
Step 12	**default** | **exit** | **loss** | **no** | **throughput** | **receive** | **delay** | **jitter**	Specifies the measurement type based on which the service performance is calculated. The options are: • **default** - Sets a command to its default value. • **loss** - Specifies the measurement such as frame loss. • **throughput** - Specifies the measurement such as average rate of successful frame delivery. • **receive** - Specifies the passive measurement mode. • **delay** - Specifies the measurement that is frame delay (FTD). • **jitter** - Specifies the measurement that is frame delay variation (FDV).

Example

```
ip sla 1
 service-performance type ip dest-ip-addr 150.1.1.2 interface TenGigabitEthernet0/0/3 service
 instance 1
  frequency iteration 1 delay 1
 measurement-type direction internal conform-color dscp af11 exceed-color dscp af12
   loss
   receive
   throughput
   delay
   jitter
```

```
 profile packet
 source-ip-addr 2.2.1.2
 packet-size 512
 outer-vlan 10
profile traffic direction internal
 cir 100000
 eir 100000
 rate-step kbps 200000
 conform-color set-dscp-transmit af11
 exceed-color set-dscp-transmit af12
duration time 1200
```

Configuring IP Target Color-Aware IMIX Traffic Generation

Perform the following steps to configure IP target color-aware IMIX traffic generation session.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ip dest-mac-addr** *dest_ip_addr* {**interface** *interface* | **interface** *interface* [**service instance** *efp-id*] | **vrf** *vrf_id*} **Example:** `Device(config-ip-sla))#service-performance type ip dest-ip-addr 194.168.1.1 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as IPt and the destination IP address. Specifies the target for the SLA session. The options are: • service instance • interface • vrf
Step 5	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iterations.
Step 6	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Specifies the time period to send packets.

	Command or Action	Purpose
Step 7	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 8	**default** | **exit** | **no** | **packet-size imix** | **source-ip-addr** **Example:** `Device(config-ip-sla-service-performance-packet)#packet-size imix`	Specifies the packet type. The options are: • **default** - Sets a command to its defaults. • **exit** - Exists the packet mode. • **no** - Negates a command or set its default. • **packet-size** - Specifies the packet size in bytes; the default size is 64. The supported packet sizes are 64,128, 256, 512, 1024, 1280, 1518, 9216 bytes, and IMIX. **Note** For IMIX, the packet-size should be explicitly mentioned as IMIX. • **source-ip-addr** - Specifies the source IP address. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session.
Step 9	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the profile packet mode.

Step 10	**profile packet direction internal cir** *number* or **eir** *number* or **cbs** *number* or **ebs** *number* or **conform-color set-dscp-transmit** *dscp_value* or **exceed-color set-dscp-transmit** *dscp_value* or **default** or **exit** or **no** or **rate step kbps**
	Example:
	`Device(config-ip-sla-service-performance)#profile traffic direction internal`
	`Device(config-ip-sla-service-performance-traffic)# cir 45000`
	`Device(config-ip-sla-service-performance-traffic)# eir 45000`
	`Device(config-ip-sla-service-performance-traffic)# conform-color set-dscp-transmit af43`
	`Device(config-ip-sla-service-performance-traffi`
		Specifies the in-line traffic profile or enables the selection of a pre-configured traffic profile. A traffic profile defines an upper limit on the volume of the expected service frames belonging to a particular service instance. If a traffic profile is not specified, the Service Performance probe is in passive measurement mode.
		• **cir** - It is the Committed Information Rate.
		• **cbs** - It is the Committed Burst Size.
		• **conform-color** - Sets the conform color.
		• **default** - Sets a command to its defaults.

	Command or Action	Purpose
	c)# exceed-color set-dscp-transmit af41 Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000	• **drop** - Drops the packet. • **eir** - It is the Excess Information rate. • **ebs** - It is the Excess Burst Size. • **exceed-color** - Sets the exceed color. • **exit** - Exits the traffic mode. • **no** - Negates a command or sets its defaults. • **rate step kbps** - Sets the rate step. • **set-cos-transmit** *cos_value* - Sets the CoS value to a new value, and sends the packet. The valid range is from 0 to 7. • **transmit** - Sends the packet without altering it. This is the default value. **Note** This command is required to configure the rate step kbps command. • **default** - Sets a command to its defaults.
Step 11	**default** or **exit** or **no** or **rate step kbps**	Specifies the traffic type. The options are: • **default**: Set a command to its default value. • **rate step kbps**: Specifies the transmission rate in kbps. The rate-step range is from 1-1000000 (1 Kbps to 1Gbps).

Example

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 vrf 2
frequency iteration 1 delay 1
duration time 50
profile packet
source-ip-addr 193.168.1.1
packet-size imix
profile traffic direction internal
cir 45000
eir 45000
cbs 45000
ebs 45000
rate-step kbps 50000 90000
conform-color set-dscp-transmit af43
exceed-color set-dscp-transmit af41
```

Generating Traffic Using Y.1564

Follow these steps to generate traffic using Y.1564:

Procedure

	Command or Action	Purpose
Step 1	Configure Ethernet Virtual Circuits (EVC).	EVC is configured on the interface path such that the layer 2 path between the transmitter and the receiver is complete. For more information, see the "Configuring Ethernet Virtual Connections (EVCs)" section in the *Carrier Ethernet Configuration Guide, Cisco IOS XE Release* .

Step 2	Configure Traffic Generator on the transmitter.
	Example:
	The following is a sample configuration of the traffic generator.
	`Device(config)# ip sla 100`
	`Device(config-ip-sla)#`
	`service-performance type ethernet`
	`dest-mac-addr 0001.0002.0003 interface`
	`TenGigabitEthernet0/0/4 service instance`
	`100`
	`Device(config-ip-sla-service-performance)#`
	`aggregation interval buckets 2`
	`Device(config-ip-sla-service-performance)#`
	`frequency iteration 2 delay 10`
	`Device(config-ip-sla-service-performance)#`
	`profile packet`
	`Device(config-sla-service-performance-packet)#`
	`packet-size 256`
	`Device(config-sla-service-performance-packet)#`
	`outer-vlan 100`
	`Device(config-sla-service-performance-packet)#`
	`profile traffic direction external`
	`Device(config-sla-service-performance-traffic)#`
	`rate-step kbps 1000`
	`Device(config-ip-sla-service-performance)#`
	`end`
	`Device #`	

Step 3	Configure Ethernet Loopback at the remote end.	For information on Ethernet Loopback, see "Understanding Ethernet Loopback" section in the *Layer 2 Configuration Guide, Cisco IOS XE Release* .
Step 4	Configure loopback on SAT IP SLA configuration itself at the remote end. **Example:** `ip sla 1`	

	Command or Action	Purpose
	service-performance type ethernet dest-mac-addr 0001.0001.0001 interface GigabitEthernet0/0/3 service instance 2 loopback direction external profile packet inner-vlan 20 outer-vlan 10 src-mac-addr 0002.0002.0002 duration time 5000	
Step 5	Start the IP SLA session: **Example:** `Router(config)# ip sla schedule [sla_id] start-time [hh:mm | hh:mm:ss | now | pending | random]`	**Note** Due to packet overhead (64-byte packets), a total of only 469 Mbit/sec of traffic is supported at a time. This bandwidth is shared by all active sessions. This is applicable only for Cisco RSP2 module. For more information, see Table 4.

Configuring Y.1564 Traffic payload pattern

Perform the following steps to configure Y.1564 Traffic payload pattern.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ethernet dest-mac-addr** *dest-mac-addr* |**interface** *interface* [**service instance** *efp-id*] **Example:** `Device(config-ip-sla))#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/0/10 service instance 10`	Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format. Specifies the target for the SLA session. The options are: • Service instance • Bridge

	Command or Action	Purpose
Step 5	**signature 45**] **Example:** `Device(config-ip-sla-service-performance)#signature 45`	Specifies the payload pattern for Y.1564 traffic.
Step 6	**exit** **Example:** `Device(config-ip-sla-service-performance)#exit`	Exits mode.

Configuration Examples for Configuring Y.1564 to Generate and Measure Ethernet Traffic

This section shows sample configurations for traffic generation.

Example: Traffic Generation — Target Service Instance

This section shows sample configuration for traffic generation – target service instance.

```
ip sla 100
service-performance type ethernet dest-mac-addr 0001.0002.0003 interface
TenGigabitEthernet0/0/4 service instance 100
profile packet
packet-size 256
outer-vlan 100
profile traffic direction internal
rate-step kbps 1000
aggregation interval buckets 2
frequency iteration 2 delay 10
end
```

Example: Traffic Generation — Target Bridge Domain

This section shows sample configuration for traffic generation – target bridge domain.

```
ip sla 100
service-performance type ethernet dest-mac-addr 0001.0002.0003 bridge-domain 100
profile packet
packet-size 256
outer-vlan 100
aggregation interval buckets 2
frequency iteration 2 delay 10
end
```

Example: Two-Way Session—Target Service Instance

The following is a sample configuration for a two-way measurement session of service instance internal target type.

```
ip sla 100
service-performance type ethernet dest-mac-addr 0001.0002.0003 interface
TenGigabitEthernet0/0/2 service instance 100
measurement-type direction internal
loss
throughput

delay
jitter
profile packet
packet-size 64
outer-vlan 100
inner-vlan 200
profile traffic direction internal
rate-step kbps 1000
aggregation interval buckets 2
frequency iteration 2 delay 10
end
```

Example: Two-Way Session — Target Bridge Domain

The following is a sample configuration for a two-way internal measurement and generation session with target type Bridge Domain.

```
ip sla 100
service-performance type ethernet dest-mac-addr 0001.0002.0003 bridge-domain 100
measurement-type direction internal
loss
throughput
delay
jitter
profile packet
packet-size 64
outer-vlan 100
inner-vlan 200
profile traffic direction internal
rate-step kbps 1000
aggregation interval buckets 2
frequency iteration 2 delay 10
end
```

Example: Passive Measurement Mode — Target Service Instance

The following is a sample configuration for passive measurement session for target service instance.

```
ip sla 100
service-performance type ethernet dest-mac-addr 0001.0002.0003 interface
TenGigabitEthernet0/0/4 service instance 100
measurement-type direction internal
loss
throughput
aggregation interval buckets 2
frequency iteration 2 delay 10
end
```

Example: Passive Measurement Mode — Target Bridge Domain

The following is a sample configuration for passive measurement session for bridge domain target.

```
ip sla 100
service-performance type ethernet dest-mac-addr 0001.0002.0003 bridge-domain 100
measurement-type direction internal
loss
throughput
aggregation interval buckets 2
frequency iteration 2 delay 10
end
```

Example: Traffic Generation Mode — Color Aware

The following is a sample output for traffic generation mode—color aware.

```
ip sla 3
service-performance type ether des 0033.3333.3333 int gig 0/0/7 service instance 1
 profile packet
outer-vlan 100
outer-cos 5 packet-size 128 ethertype ipv4 exit
profile traffic dir int cir 45000
eir 45000
 cbs 45000
ebs 45000
conform-color set-cos-transmit 7 exceed-color set-cos-transmit 5
rate-step kbps 30000 45000 65000 90000 exit
duration time 20
frequency iteration 1 delay 2
```

Example: Traffic Generation Mode with IMIX — Color Aware

The following is a sample output for traffic generation mode with IMIX — color aware.

```
ip sla 3
service-performance type ether des 0033.3333.3333 int gig 0/0/7 service instance 1
 profile packet
outer-vlan 100 outer-cos 5 packet-size imix ethertype ipv4 exit
profile traffic dir int
cir 45000 eir 45000
 cbs 45000
ebs 45000
conform-color set-cos-transmit 7
exceed-color set-cos-transmit 5
rate-step kbps 30000 45000 65000 90000 exit
duration time 20
frequency iteration 1 delay 2
```

Example: Two-way Color-Aware Measurement Session

The following is a sample configuration for a two-way color-aware measurement session.

```
ip sla 3
service-performance type ether des 0033.3333.3333 int gig 0/0/7 service instance 1
 profile packet
outer-vlan 100
```

```
outer-cos 5 packet-size 128 ethertype ipv4 exit
profile traffic dir int cir 45000
eir 45000
 cbs 45000
ebs 45000
conform-color set-cos-transmit 7 exceed-color set-cos-transmit 5
rate-step kbps 30000 45000 65000 90000 exit
measure dir internal conform-color cos 7 exceed-color cos 5 receive
throughput loss delay jitter
duration time 20
frequency iteration 1 delay 2
```

Example: Passive Color-Aware Measurement Session

The following is a sample configuration for a passive color-aware measurement session.

```
ip sla 3
service-performance type ether des 0033.3333.3333 int gig 0/0/7 service instance 1
 profile packet
outer-vlan 100 outer-cos 5 packet-size 128 ethertype ipv4 exit
measure dir internal conform-color cos 7 exceed-color cos 5 receive
throughput
loss
duration time 20
frequency iteration 1 delay 2
```

Example: Two-Way Session

The following is a sample configuration for a two-way session.

```
show ip sla statistics 12345

IPSLAs Latest Operation Statistics

IPSLA operation id: 12345
Type of operation: Ethernet Service Performance
Test mode: Two-way Measurement
Steps Tested (kbps): 10000 20000 25000
Test duration: 20 seconds

Latest measurement:  *15:54:44.007 IST Mon May 18 2015
Latest return code:  Oper End of Life

Overall Throughput: 24850 kbps

Step 1 (10000 kbps):
Stats:
IR(kbps) FL   FLR      Avail              FTD Min/Avg/Max      FDV Min/Avg/Max
9944      0     0.00%  100.00%  41.44us/46.06us/77.68us  0ns/12.08us/34.52us
Tx Packets: 16377 Tx Bytes: 24860286
Rx Packets: 16377 Rx Bytes: 24860286
Step Duration: 20 seconds
```

Example: 10G Ethernet Two-Way Color Blind Session on Cisco RSP2 Module

The following is a sample configuration for a 10G ethernet two-way color blind session:

```
router#show run | sec ip sla 200
ip sla 200
service-performance type ethernet dest-mac-addr 0000.0000.2200 interface
TenGigabitEthernet0/0/2 service instance 200
  frequency iteration 2 delay 10
  aggregation interval buckets 2
  measurement-type direction external
   loss
   receive
   throughput
  profile packet
   outer-cos 2
   outer-vlan 200
   packet-size 1024
   src-mac-addr 0000.0000.4400
  profile traffic direction external
   rate-step kbps 9000000
  duration time 60
```

The following is the sample output for the 10G ethernet two-way color blind session:

```
router#show ip sla statistics 200
IPSLAs Latest Operation Statistics

IPSLA operation id: 200
Type of operation: Ethernet Service Performance
Test mode: Two-way Measurement
Steps Tested (kbps): 9000000
Test duration: 60 seconds

Latest measurement:  *18:04:34.975 IST Wed Mar 29 2017
Latest return code:  Oper End of Life

Overall Throughput: 8943460 kbps

Step 1 (9000000 kbps):
Stats:
IR(kbps)  FL          FLR      Avail
8943460   0           0.00%    100.00%
Tx Packets: 65503860  Tx Bytes: 67075952640
Rx Packets: 65503860  Rx Bytes: 67075952640
Step Duration: 60 seconds
```

Configuration Examples for Configuring Y.1564 t o Generate and Measure IP Traffic

This section shows sample configurations for IP traffic generation and measurement.

Example: Passive Color-Aware Measurement Session

The following is a sample configuration for passive color-aware measurement session.

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 interface TenGigabitEthernet0/0/3
service instance 1
frequency iteration 1 delay 1
duration time 50
measurement-type direction internal
```

```
conform-color dscp af43
exceed-color dscp af41
receive
profile packet
source-ip-addr 193.168.1.1
packet-size 512
```

Example: Color-Aware IMIX — Traffic Generation

The following is a sample configuration for color-aware IMIX — traffic generation session.

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 interface TenGigabitEthernet0/0/3
service instance 1
frequency iteration 1 delay 1
duration time 50
profile packet
source-ip-addr 193.168.1.1
packet-size imix
profile traffic direction internal
cir 45000
eir 45000
cbs 45000
ebs 45000
rate-step kbps 50000 90000
conform-color set-dscp-transmit af43
exceed-color set-dscp-transmit af41
```

Example: Color-Aware — Traffic Generation

The following is a sample configuration for color-aware — traffic generation session.

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 interface TenGigabitEthernet0/0/3
frequency iteration 1 delay 1
duration time 50
profile packet
source-ip-addr 193.168.1.1
packet-size 512
profile traffic direction internal
cir 45000
eir 45000
cbs 45000
ebs 45000
rate-step kbps 50000 90000
conform-color set-dscp-transmit af43
exceed-color set-dscp-transmit af41
```

Example: Color Blind — Traffic Generation

The following is a sample configuration for a color blind — traffic generation session.

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 bridge-domain 100
frequency iteration 1 delay 1
duration time 50
profile packet
source-ip-addr 193.168.1.1
```

```
packet-size 512
profile traffic direction internal
rate-step kbps 50000 90000
```

Example: Color Blind — Passive Measurement

The following is a sample configuration for a color blind — passive measurement session.

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 vrf 2
frequency iteration 1 delay 1
duration time 50
measurement-type direction internal
receive
profile packet
source-ip-addr 193.168.1.1
packet-size 512
```

Example: Color-Aware — Two Way

The following is a sample configuration for a color-aware — two way session.

```
ip sla 1
 service-performance type ip dest-ip-addr 150.1.1.2 interface TenGigabitEthernet0/0/3 service
 instance 1
  frequency iteration 1 delay 1
 measurement-type direction internal conform-color dscp af11 exceed-color dscp af12
   loss
   receive
   throughput
   delay
   jitter
   profile packet
   source-ip-addr 2.2.1.2
   packet-size 512
   outer-vlan 10
  profile traffic direction internal
   cir 100000
   eir 100000
   rate-step kbps 200000
   conform-color set-dscp-transmit af11
   exceed-color set-dscp-transmit af12
  duration time 100
```

Example: Color Blind — Two Way

The following is a sample configuration for a color blind — two way session.

```
ip sla 1
 service-performance type ip dest-ip-addr 150.1.1.2 interface TenGigabitEthernet0/0/3 service
 instance 1
  frequency iteration 1 delay 1
 measurement-type direction internal
   loss
   receive
   throughput
   delay
   jitter
```

```
 profile packet
 source-ip-addr 2.2.1.2
 packet-size 512
 outer-vlan 10
profile traffic direction internal
 rate-step kbps 200000
duration time 100
```

Example: Configuring Y1564 Traffic Payload Pattern

The following is a sample configuration for a Y1564 Traffic Payload Pattern:

```
ip sla 101
service-performance type ethernet dest-mac-addr 0012.1212.1221 interface
TenGigabitEthernet0/3/1 service instance 100
signature 32
measurement-type direction external
throughput
profile packet
src-mac-addr 4055.3989.7b56
profile traffic direction external
rate-step kbps 1000
duration time 60
```

How to Configure IP (Layer 3) Loopback on Responder

This section shows how to configure IP (Layer 3) loopback on responder.

Note This feature is not supported on Cisco ASR 900 RSP3 Module.

Enabling IP SLA Loopback on Responder

Perform the following steps to configure ethernet target traffic generation.

Note For layer 3 Loopback, the parameters **dest-ip-addr** and **src-ip-addr** are mandatory, otherwise the configuration fails. **Outer-vlan** is mandatory only for Trunk EFP and optional for other interface types.

Procedure

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

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip sla** *sla_id* **Example:** `Device(config)# ip sla 100`	Specifies the SLA ID to start the IP SLA session.
Step 4	**service-performance type ip dest-ip-addr** *dest-ip-addr* **interface** *interface* **Example:** `Device(config-ip-sla))#service-performance type ip dest-ip-addr 194.168.1.1 interface gigabitEthernet0/0/1`	Specifies the service performance type as IP and the destination IP address. Specifies the target for the SLA session. The options are: • service instance • interface • vrf • bridge-domain
Step 5	**frequency iteration** *number* **delay** *number* **Example:** `Device(config-ip-sla)# frequency iteration 1 delay 2`	Specifies the number of interactions and delay between the iteration.
Step 6	**loopback direction** {*internal*} **Example:** `Device(config-ip-sla)# loopback direction internal`	Configures loopback direction.
Step 7	**duration time** *seconds* **Example:** `Device(config-ip-sla)# duration time 30`	Specifies the time period to send packets.
Step 8	**profile packet** **Example:** `Device(config-ip-sla-service-performance)# profile packet`	Specifies the packet profile. A packet profile defines the packets to be generated.

Step 9	**source-ip-addr** *ip-address* | **outer-vlan** *vlan-id*
	Example:
	`Device(config-ip-sla-service-performance-packet)# source-ip-addr 51.1.1.1`
	`Device(config-ip-sla-service-performance-packet)# outer-vlan 301`
		Specifies the packet type. The options are:
		• **default** - Sets a command to its defaults.
		• **exit** - Exists the packet mode.
		• **no** - Negates a command or set its defaults.

	Command or Action	Purpose
		• **source-ip-addr** - Specifies the source IP address. • **outer-vlan** - Specifies the VLAN ID that is populated in the outer VLAN tag of the packet. **Note** Ensure that the value of the configured packet profile matches the target configuration of the session.
Step 10	**exit** **Example:** `Device(config-ip-sla-service-performance-packet)#exit`	Exits the profile packet mode.

Example

```
ip sla 1
service-performance type ip dest-ip-addr 194.168.1.1 interface gi0/0/0 service instance 1
frequency iteration 1 delay 1
loopback direction internal
profile packet
source-ip-addr 193.168.1.1
outer-vlan 301
duration time 30000
```

SADT Overhead Accounting

FPGA measures the following parameters for SADT:

- Throughput
- Frame Loss
- Jitter
- Delay

FPGA has the capability to generate and measure only 1Gbps traffic rate and hence maximum throughput cannot be achieved.

The following table shows the packet size and the maximum rate that can be achieved.

Packet Size (Bytes)	1G Maximum Rate (kbps)
64	469848
128	638061

Packet Size (Bytes)	1G Maximum Rate (kbps)
256	775123
512	867758
1024	922728
1280	934554
1518	942124
9216	977675
IMIX	788000

To overcome this limitation, use the **platform y1564 shadow-session-enable** command to replicate the packets 10 times in FPGA.

Restrictions

- The platform y1564 **shadow-session-enable** command does not work in HA setup.
- While using platform y1564 **shadow-session-enable** command, SADT session uses a shadow session with the given MAC + 1 (for example, 0011.1111.2222 to 0011.1111.2223). Hence source MAC and destination MAC must not be in consecutive numbers.
- Use external Ethernet data plane loopback (ELB) for this feature as 1G internal loopback is not supported.
- 1G internal SADT only supports EFP cross connect EFP.
- 1G SADT is *not* supported on local connect and layer 2 VFI.
- Color-aware configurations are *not* supported on 1G SADT.
- 1G SADT can *only* be configured in two-way mode.
- 1G SADT target type is *only* supported on access EFP.
- A combination of 1G and 10G SADT sessions cannot be performed in parallel. Also, two 10G SADT sessions cannot be performed in parallel.
- SADT statistics can *only* be validated after SADT operation is complete.
- Layer 3 packets are *not* supported when SADT overhead accounting is enabled.
- You should configure the parameters that are *only* related to layer 2 for a packet profile.
- Overall throughput value slightly differs the rate step value.
- Multiple rate steps of a single command should be added in an incremental order.
- While QoS egress shaper policy is applied on the same SAT interface with 1G SADT, SAT traffic generation is affected based on the shaper value. There is no effect on the traffic when inbound policer-based policy is applied on the same SAT interface.

- Broadcast and multicast destination MAC are *not* supported.
- You should define the rate-steps upper limits of SADT to provide bandwidth to BFD and avoid the OSPF flaps.
- Online Insertion and Removal (OIR) and Stateful Switchover (SSO) are *not* supported. SLA session must be stopped and re-started manually after these triggers are generated.
- SADT SLA session and ELB on the same service instance of an interface are *not* supported.
- 1G SADT on encapsulation default does not work when untagged encapsulation is configured on the interface.
- 1G SADT is *not* supported on VRF and Port-Channel interfaces.

Configuring SADT Overhead Accounting

To configure SADT Overhead Accounting:

```
enable
configure terminal
platform y1564 shadow-session-enable
```

To remove the configuration:

```
enable
configure terminal
no platform y1564 shadow-session-enable
```

Verifying SADT Overhead Accounting Configuration

Use **show run | sec platform y1564** command to verify SADT overhead accounting configuration as follows:

```
Router#show run | sec platform y1564platform y1564 shadow-session-enable


Router#sh ip sla statistics
IPSLAs Latest Operation Statistics

IPSLA operation id: 102
Type of operation: Ethernet Service Performance
Test mode: Two-way Measurement
Steps Tested (kbps): 500000
Test duration: 30 seconds

Latest measurement:  15:22:35.807 IST Thu Nov 7 2019
Latest return code:  OK

Overall Throughput: 499871 kbps

Step 1 (500000 kbps):
Stats:
IR(kbps)  FL          FLR      Avail    FTD Min/Avg/Max      FDV Min/Avg/Max
499871    0           0.00%    100.00%  59.44us/98.93us/102.56us  800ns/3.54us/42.48us
Tx Packets: 28401828  Tx Bytes: 1874520648
Rx Packets: 28401828  Rx Bytes: 1874520648
Step Duration: 30 seconds
```

Configurable User-Defined and EMIX Packet Size

Table 14: Feature History

Feature Name	Release	Description
Configurable Y.1564 Service Activation Frame Sizes and EMIX Support	Cisco IOS XE Amsterdam 17.3.1	Starting with Cisco IOS XE Amsterdam 17.3.1 release, EMIX packet size is supported. For EMIX traffic, packet sizes of 64, 128, 256, 1024 and 1518 bytes are supported. These packet sizes are forwarded in ratio of 1:1:1:1:1.
SAT based support for configurable EMIX traffic pattern in FPGA	Cisco IOS XE Bengaluru 17.4.1	The support for EMIX packet size is enhanced. For EMIX traffic, packet sizes of 64, 128, 256, 512, 1024, 1280, 1518, Maximum Transmission Unit (MTU) and user-defined patterns are supported. These packet sizes are forwarded in ratio of 1:1:1:1:1.
EMIX Sequence Enhancement	Cisco IOS XE Bengaluru 17.4.1	This feature enables SAT based support for configurable EMIX traffic pattern in FPGA-based SAT.
Configurable User-Defined and EMIX Packet Size	Cisco IOS XE Bengaluru 17.4.1	This feature allows you to configure user-defined and Enterprise traffic (EMIX) packet sizes. Use the following commands to configure user-defined and EMIX packet sizes: • **packet-size user-defined** *packet size* • **packet-size emix sequence** *emix-sequence* [**u-value** *u-value value*]

EMIX patterns are to be specified by the size designator for each frame in the repeating pattern. The following table is an example of the EMIX test profile.

Starting with Cisco IOS XE Release 16.12.4, EMIX packet size (default abceg pattern) is supported. For EMIX traffic, ITU-T Rec. Y.1564 packet sizes of 64, 128, 256, 1024, and 1518 bytes are supported.

The following table shows the configurable packet size patterns. You must specify the EMIX patterns using the size designator for each frame in the repeating pattern. For example, in the above table, you can specify an eight-frame repeating pattern as follows:

Table 15: Configuring EMIX Frame Size

EMIX Definition	a	b	c	d	e	f	g	h	(u) User Defined
EMIX size (in bytes)	64	128	256	512	1024	1280	1518	Service MTU	Range is from 64-9216

Note SAT traffic is not transmitted as per the configured emix sequence order on the router.

- Starting with Cisco IOS XE Amsterdam 17.3.1 release, EMIX packet size (default abceg pattern) is supported on both, RSP2 and RSP3 modules. On the Cisco RSP3 module, it is supported in FPGA-based SADT. For EMIX traffic, ITU-T Rec. Y.1564 packet sizes of 64, 128, 256, 1024, and 1518 bytes are supported.
- The IP SLA packets are generated and forwarded in ratio of 1:1:1:1:1 from UNI or NNI port based on your configuration.
- Starting from Cisco IOS XE Bengaluru 17.4.1 release, EMIX packet size of 62, 128, 256, 512, 1024, 1280, 1518, MTU and *user-defined* bytes are supported. You can configure the SLA using Maximum Transmission Unit (MTU) of Ethernet interface.

  A maximum of eight characters in the **packet-size emix sequence abcdefgh** command is supported. In case you want to use **u**, then you must include **u-value** in the command.
- You can specify the packet size according to Y1564 and assign the user-specified MTU using a hex pattern (**abcdefghu**).
  - EMIX – **abcdefghu** = 64, 128, 256, 512, 1024, 1280, 1518, MTU, *user-defined*

    EMIX – **aabbccuu** = 64, 64, 128, 128, 256, 256, *user-defined*, *user-defined*
- The EMIX pattern must be configurable for the service test.
- Data loss equal to the egress MTU drop is observed when Y1564 is used to configure BDI and h in EMIX sequence.
- EMIX sequence is supported with platform **platform y1564 shadow-session enable** command.
- When the **platform y1564 shadow-session enable** command is enabled, you cannot configure two parallel sessions for 1G interface.

Configuration Example: Configurable User-Defined and EMIX Packet Size

The following example shows the configuration of user-defined packet size:

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip sla 1
Router(config-ip-sla)#service-performance type ethernet dest-mac-addr aaa.ccc.aaa interface
 Gi0/1
Router(config-ip-sla-service-performance)#profile packet
Router(config-sla-service-performance-packet)#packet-size ?
```

```
  1024          1024 byte
  128           128 byte
  1280          1280 byte
  1518          1518 byte
  256           256 byte
  512           512 byte
  64            64 byte
  9216          9216 byte
  emix          Emix packet size
  imix          Imix packet size
  user-defined  User defined Packet Size
Router(config-sla-service-performance-packet)#packet-size user-defined 2955
Router(config-sla-service-performance-packet)#end
```

The following example shows the configuration of EMIX packet size:

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip sla 1
Router(config-ip-sla)#service-performance type ethernet dest-mac-addr aaa.ccc.aaa interface
 Gi0/1
Router(config-ip-sla-service-performance)#profile packet
Router(config-sla-service-performance-packet)#packet-size ?
  1024  1024 byte
  128   128 byte
  1280  1280 byte
  1518  1518 byte
  256   256 byte
  512   512 byte
  64    64 byte
  9216  9216 byte
  emix  Emix packet size
  imix  Imix packet size

Router(config-sla-service-performance-packet)#packet-size em
Router(config-sla-service-performance-packet)#packet-size emix ?
  sequence  Specify the EMIX sequence
  <cr>      <cr>

Router(config-sla-service-performance-packet)#packet-size emix sequence ?
  WORD  EMIX Sequence

Router(config-sla-service-performance-packet)#packet-size emix sequence aaabbcc ?
 u-value  Specify the user-defined value
  <cr>     <cr>

Router(config-sla-service-performance-packet)#packet-size emix sequence aaabbbccu u-value
?
  <64-10236>  Specify user-defined packet size value

Router(config-sla-service-performance-packet)#packet-size emix sequence aaabbbccu u-value
128 ?
  <cr>  <cr>
```

Verification of User-Defined and EMIX Packet Size Configuration

Use **show run | sec sla** command to verify user-defined packet size configuration.

```
Router# show run | sec sla
ip sla 100
service-performance type ethernet dest-mac-addr aaaa.bbbb.cccc interface GigabitEthernet0/1
```

```
  profile packet
   packet-size user-defined 2955
```

Use **show run | sec sla** command to verify EMIX packet size configuration.

```
Router#show run | section sla
ip sla 1
service-performance type ethernet dest-mac-addr 0aaa.0ccc.0aaa interface GigabitEthernet0/1

  profile packet
   packet-size emix sequence aabbccu u-value 128
```

Additional References for IP SLA - Service Performance Testing

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Cisco IOS IP SLAs commands	Cisco IOS IP SLAs Command Reference

Standards and RFCs

Standard/RFC	Title
ITU-T Y.1564	*Ethernet service activation test methodology*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html