



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.

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Information About Service Performance Operations

Y.1564 is an Ethernet service activation test methodology. It 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 performance testing is designed to measure the ability of a Device Under Test (DUT) or a network under test to forward traffic in different states.

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

Effective with Cisco IOS XE Everest Release 16.12.1, 10 Gigabit (10G) SAT Internal session is supported. 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.
- 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 indicate the configured SLAs for the service or stream. These following service acceptance criteria metrics are:

- 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.



Note If the delay is more than 4.2 sec, then the software is not capable of capturing it in SADT statistics.

- 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.

Table 1: Supported Key Performance Indicators Matrix

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

Because they interconnect segments, forwarding devices (switches and routers) and network interface units are the basis of any network. Incorrect configuration of a service on any of these devices within the end-to-end path, can affect the network performance. This could also lead 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 forward traffic in different states. The Cisco implementation of ITU-T Y.1564 includes the following service performance tests:

- Minimum data rate to CIR—Generates bandwidth from the minimum data rate to the committed information rate (CIR) for the test stream. Measures KPI for Y.1564 to meet configured service acceptance criteria (SAC).

- CIR to EIR—Ramps up bandwidth from the CIR to the excess information rate (EIR) for the test stream. Measures the transfer rate to ensure that CIR meets the minimum bandwidth of the maximum EIR. Other KPI is not measured.



Note In SADT configuration, if the rate of EIR is greater than CIR + EIR, then above EIR is not measured. The stats for *Above EIR* remains 0 in following command: **show ip sla statistics**

Service performance supports four operational modes:

- Two-way statistics collection
- One-way statistics collection
- Passive measurement mode
- 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 are executed.

- One-way statistics collection—Both the passive measurement mode and the traffic generator mode are used along 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 the statistics instead of looping back the traffic. The sending device records only the transmit statistics.
- Two-way statistics collection—The sender collects all the measurements. 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 sent back 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 statistics for the number of packets and bytes transmitted.

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.

Restrictions for IP SLA - Service Performance Operation

- SADT color aware or color blind works only if you have configured rewrite in interface EFP, else the behavior is inconsistent.
- 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.
- Facility loopback session cannot be started on a port configured as a SPAN source.
- Terminal SLA session cannot be started on a port configured as a SPAN destination.
- Facility SLA session cannot be started on a port configured as a SPAN source.
- 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 2: 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 3: 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 on the router.
- 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.
- For the color aware SADT to work as expected, rewrite EFP should be present.

Restrictions on the Cisco ASR 920 Routers

- 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.
- When the source MAC address is not configured on layer 2 SLA, any one system reserved MAC of 16 MAC addresses is used.
- 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.
- With 10G SAT, only throughput and frame loss can be measured. Delay and jitter measurements are not supported.
- 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. Also, two 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.
- Duration time is rounded off in multiples of 10.
- 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.
- Overall throughput in the system is slightly lesser than the rate-step mentioned value.
- 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.
- Broadcast and multicast destination MAC is not supported.
- 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 run. That is, parallel execution is not supported with 10G SAT.
- 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 SAT session. 10G SAT on encapsulation default does not work when encapsulation untagged is configured on the interface.
- Even with 10G SAT, maximum FPGA available 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).
- As 10G internal loopback is not supported, the router should have the external ELB (loopback) enabled.
- 10G SADT internal 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.

Restrictions for SAT Two-Way Sessions on EFP Xconnect on the Cisco ASR 920 Routers

- 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 for FPGA Based SAT

The following restrictions are applicable only on the Cisco ASR-920-12SZ-A, Cisco ASR-920-12SZ-D, Cisco ASR-920-12SZ-IM, and Cisco ASR-920U-12SZ-IM variants of the Cisco ASR 920 router:

- 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.
- If a source MAC address is not configured and if free unique MAC addresses are not available in the MAC pool on the node then the IP SLA schedule/restart CLI will stop with proper console logs and the IP SLA session with unique source mac specified by IP SLA configuration has to be initiated.
- 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 TEF.
- SADT supports only two rate three color policy.

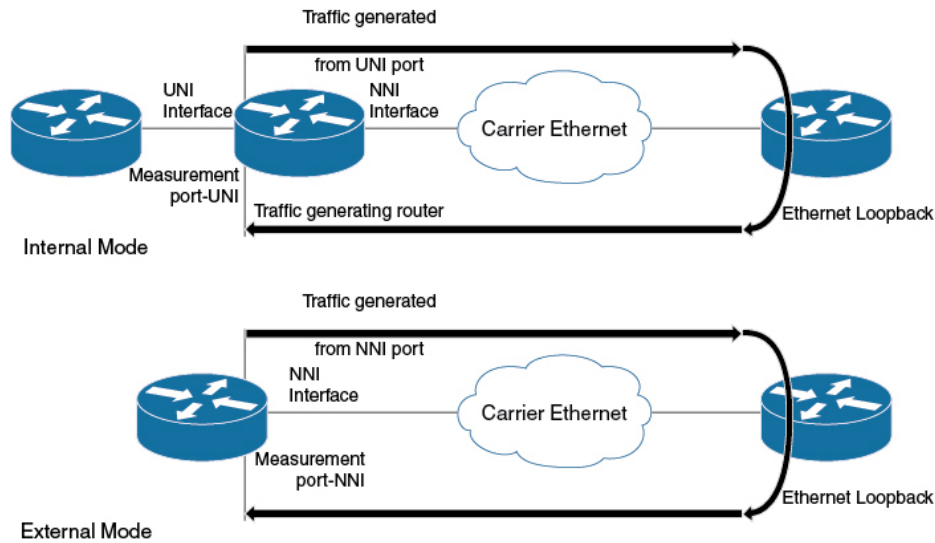
Information About Configuring Y.1564 to Generate and Measure Ethernet Traffic

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



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

Table 4: Service Types and Their Corresponding Traffic Direction for IP Target SLA

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

Table 5: Service Types and Their Corresponding Traffic Direction for Ethernet Target SLA

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

Scale and Limitations for Configuring IP SLA - Service Performance Operation

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

Table 6: Scaling Numbers for IP SLA

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

**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.

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

Table 7: Throughput Measurement for Each Packet Size

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

Packet Size (Bytes)	1G Max Rate (kbps)	10G Max Rate (kbps)
1518	942124	9421240
9216	977675	9776750
IMIX	788000	7880000



Note The Max Rate mentioned in the table 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.



Note With a given frequency time configuration, SLA will run for duration time configured on the SLA and restart after the delay time. It will continue to get into a loop until the life time configuration. To calculate delay time use delay time = frequency time - duration time.

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 <i>Carrier Ethernet Configuration Guide, Cisco IOS XE Release</i> .
Step 2	Configure Traffic Generator on the transmitter. Example: The following is a sample configuration of the traffic generator. <pre> 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)# </pre>	

	Command or Action	Purpose
	<pre> 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 # </pre>	
Step 3	Configure Ethernet Loopback at the remote end.	For information on Ethernet Loopback, see "Understanding Ethernet Loopback" section in the <i>Layer 2 Configuration Guide, Cisco IOS XE Release</i> .
Step 4	<p>Start the IP SLA session:</p> <p>Example:</p> <pre> Router(config)# ip sla schedule [sla_id] start-time [hh:mm hh:mm:ss now pending random] </pre>	<p>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.</p>

How to Configure IP SLA - Service Performance Testing

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	<p>enable</p> <p>Example:</p> <pre>Device> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<p>configure terminal</p> <p>Example:</p> <pre>Device# configure terminal</pre>	Enters global configuration mode.
Step 3	<p>ip sla <i>sla_id</i></p> <p>Example:</p> <pre>Device(config)# ip sla 100</pre>	Specifies the SLA ID to start the IP SLA session.

	Command or Action	Purpose
Step 4	service-performance type ethernet dest-mac-addr <i>dest-mac</i> { service instance bridge } Example: <pre>Device(config-ip-sla)#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/10 service instance 10</pre>	<p>Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format.</p> <p>Specifies the target for the SLA session. The options are:</p> <ul style="list-style-type: none"> • service instance • bridge <p>Only service instance is supported as target-type on 10G SAT.</p>
Step 5	aggregation default description duration exit frequency no profile Example: <pre>Device(config-ip-sla-service-performance)# duration time 60</pre>	<p>Specifies the type of service performance. The options are:</p> <ul style="list-style-type: none"> • 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 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: <pre>Device(config-ip-sla-service-performance)# measurement-type direction</pre>	<p>Specifies the statistics to measure traffic. The options available are external or internal; the default option is internal.</p> <p>Only external measurement-type direction is supported for 10G.</p>
Step 7	default exit loss no throughput receive delay jitter Example: <pre>Device(config-ip-sla-service-performance-measurement)# throughput</pre>	<p>Specifies the measurement type based on the service performance is calculated. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults. • loss - Specifies the measurement, such as frame loss.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • 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. • jitter - Specifies the measurement that is frame delay variation (FDV). This is not supported on 10G.
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 Example: Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56	Specifies the packet type. The options are: <ul style="list-style-type: none"> • 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 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.

	Command or Action	Purpose
		Note Ensure that the value of the configured packet profile matches the target configuration of the session.
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. 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: <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • 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 <i>sla_id</i> 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 <i>dest-mac-addr</i> {bridge-domain <i>domain_id</i> interface interface [<i>service instance efp-id</i>]} 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 option is: <ul style="list-style-type: none">• service instance
Step 5	frequency iteration <i>number</i> delay <i>number</i> Example: Device(config-ip-sla)# frequency iteration 1 delay 2	Specifies the number of interactions and delay between the iteration.
Step 6	duration time <i>seconds</i> 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 Example: Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56	Specifies the packet type. The options are: <ul style="list-style-type: none">• 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
		<ul style="list-style-type: none"> • 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. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
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. <ul style="list-style-type: none"> • cir - Committed Information Rate. • cbs - Committed Burst Size. • conform-color - Sets the color conform. <p>Note coform-color and exceed-color keywords are available only when cir or eir is configured.</p> <ul style="list-style-type: none"> • 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.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • set-cos-transmit <i>cos_value</i> - 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. • 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. <p>Note The command rate-step kbps pps number is mandatory for traffic generation.</p>

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-traffic c)# cir 45000
Device(config-ip-sla-service-performance-traffic 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

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. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>sla_id</i> 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 <i>dest-mac-addr</i> [interface <i>interface</i> [service instance <i>efp-id</i>]] 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: <ul style="list-style-type: none"> • service instance • bridge
Step 5	duration time <i>seconds</i> 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 Example: Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56	Specifies the packet type. The options are: <ul style="list-style-type: none"> • 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
		<ul style="list-style-type: none"> • 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. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
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-traffic)# exceed-color set-cos-transmit 5 Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000	<p>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.</p> <ul style="list-style-type: none"> • cir - Committed Information Rate. • cbs - Committed Burst Size. • conform-color - Sets the color conform. • 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.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • set-cos-transmit <i>cos_value</i> - 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. <p>Note This command is required to configure the rate step kbps command.</p> <ul style="list-style-type: none"> • 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). <p>Note The command rate-step kbps pps number is mandatory for traffic generation.</p>
Step 10	measurement-type direction [internal external] conform-color cos <i>cos_value</i> exceed-color cos <i>cos value</i> Example: <pre>Device(config-ip-sla)# measurement-type direction internal cos 7</pre>	Specifies the direction of measurement.
Step 11	default exit loss throughput receive delay jitter Example: <pre>Device(config-ip-sla-service-performance-measurement)# throughput</pre>	<p>Specifies the measurement type based on which the service performance is calculated. The options are:</p> <ul style="list-style-type: none"> • 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). • jitter - Specifies the measurement that is frame delay variation (FDV).

	Command or Action	Purpose
Step 12	frequency iteration <i>number</i> delay <i>number</i> 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

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. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example:	Enters global configuration mode.

	Command or Action	Purpose
	Device# configure terminal	
Step 3	ip sla <i>sla_id</i> 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 <i>dest_mac_addr</i> {bridge-domain <i>domain_id</i> interface interface [<i>service instance efp-id</i>]} 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: <ul style="list-style-type: none"> • service instance • bridge
Step 5	duration time <i>seconds</i> 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 Example: Device(config-ip-sla-service-performance-packet)#src-mac-addr 4055.3989.7b56	Specifies the packet type. The options are: <ul style="list-style-type: none"> • 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.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • src-mac-addr - Specifies the source MAC address in H.H.H format. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
Step 8	exit Example: Device(config-ip-sla-service-performance-packet)#exit	Exits the profile packet mode.
Step 9	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 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: <ul style="list-style-type: none"> • 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

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. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>sla_id</i> 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 <i>dest_mac_addr</i> {bridge-domain <i>domain_id</i> interface interface [service instance <i>efp-id</i>]} 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: <ul style="list-style-type: none"> • service instance • bridge
Step 5	duration time <i>seconds</i> 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.

	Command or Action	Purpose
Step 7	<p>default exit inner-cos inner-vlan no outer-cos outer-vlan packet-size imix src-mac-addr</p> <p>Example:</p> <pre>Device(config-ip-sla-service-performance-packet)#packet-size imix</pre>	<p>Specifies the packet type. The options are:</p> <ul style="list-style-type: none"> • 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. <p>Note For IMIX, the packet-size should be explicitly mentioned as IMIX.</p> <ul style="list-style-type: none"> • src-mac-addr - Specifies the source MAC address in H.H.H format. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
Step 8	<p>exit</p> <p>Example:</p> <pre>Device(config-ip-sla-service-performance-packet)#exit</pre>	Exits the profile packet mode.
Step 9	<p>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</p>	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
	Example: <pre> 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 </pre>	<ul style="list-style-type: none"> • 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 <i>cos_value</i> - 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. <p>Note This command is required to configure the rate step kbps command.</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults.
Step 10	frequency iteration <i>number delay number</i> Example: <pre> Device(config-ip-sla)# frequency iteration 1 delay 2 </pre>	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
```

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 <i>sla_id</i> 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 <i>dest-mac-addr</i> [interface interface [<i>service instance efp-id</i>] 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: <ul style="list-style-type: none"> • Service instance • Bridge
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

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
```

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.

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 <i>sla_id</i> 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 <i>interface</i> interface <i>interface</i> [service instance <i>efp-id</i> vrf <i>vrf_id</i>} 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 <i>number</i> delay <i>number</i> Example: Device(config-ip-sla)# frequency iteration 1 delay 2	Specifies the number of interactions and delay between the iteration.
Step 6	duration time <i>seconds</i> Example: Device(config-ip-sla)# duration time 30	Specifies the time period to send packets.

	Command or Action	Purpose
Step 7	profile packet Example: <pre>Device(config-ip-sla-service-performance)# profile packet</pre>	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: <pre>Device(config-ip-sla-service-performance-packet)#src-ip-addr 193.168.1.1</pre>	<p>Specifies the packet type. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults. • exit - Exits 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. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
Step 9	exit Example: <pre>Device(config-ip-sla-service-performance-packet)#exit</pre>	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: <pre>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-traffic)</pre>	<p>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.</p> <ul style="list-style-type: none"> • 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
<pre>c)# exceed-color set-dscp-transmit af41 Device(config-ip-sla-service-performance-traffic)# c)# rate-step kbps 1000</pre>	<ul style="list-style-type: none"> • 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 mnemonic name for a commonly used value. • transmit - Sends the packet without altering it. This is the default value. <p>Note This command is required to configure the rate step kbps command.</p> <ul style="list-style-type: none"> • 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). <p>Note The rate-step kbps pps number is mandatory for traffic generation to happen.</p>

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. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>sla_id</i> 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 <i>dest-ip-addr</i> {interface <i>interface</i> bridge domain <i>domain_id</i> interface <i>interface</i> [service instance <i>efp-id</i> vrf <i>vrf_id</i>] 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: <ul style="list-style-type: none"> • service instance • interface • vrf • bridge domain
Step 5	frequency iteration <i>number</i> delay <i>number</i> Example: Device(config-ip-sla)# frequency iteration 1 delay 2	Specifies the number of interactions and delay between the iteration.
Step 6	duration time <i>seconds</i> Example: Device(config-ip-sla)# duration time 30	Sets the service performance duration configuration.

	Command or Action	Purpose
Step 7	profile packet Example: <pre>Device(config-ip-sla-service-performance)# profile packet</pre>	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: <pre>Device(config-ip-sla-service-performance-packet)#src-ip-addr 193.168.1.1</pre>	<p>Specifies the packet type. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults. • exit - Exits 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. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
Step 9	exit Example: <pre>Device(config-ip-sla-service-performance-packet)#exit</pre>	Exits the IP SLA Service Performance packet mode.
Step 10	profile traffic direction internal Example: <pre>Device(config-ip-sla-service-performance)# profile traffic direction internal</pre>	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: <pre>Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000</pre>	<p>Specifies the traffic type. The options are:</p> <ul style="list-style-type: none"> • 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
		<ul style="list-style-type: none"> • rate step pps - Specifies the transmission rate in pps. The rate-step range is from 1 to 1000000 (1 pps to 1000000 pps). <p>Note The command rate-step kbps pps number is mandatory for traffic generation.</p>

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. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>sla_id</i> 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 <i>dest_ip_addr</i> {interface <i>interface</i> bridge domain <i>domain_id</i> interface <i>interface</i> [service instance <i>efp-id</i>] vrf <i>vrf_id</i>} Example: Device(config-ip-sla)# service-performance type ip dest-ip-addr 194.168.1.1 interface	Specifies the service performance type as IP and the destination IP address. Specifies the target for the SLA session. The options are: <ul style="list-style-type: none"> • service instance • interface

	Command or Action	Purpose
	<code>gigabitEthernet0/0/10 service instance 10</code>	<ul style="list-style-type: none"> • vrf • bridge domain
Step 5	frequency iteration <i>number</i> delay <i>number</i> Example: <code>Device(config-ip-sla)# frequency iteration 1 delay 2</code>	Specifies the number of interactions and delay between the iteration.
Step 6	duration time <i>seconds</i> Example: <code>Device(config-ip-sla)# duration time 30</code>	Sets the service performance duration configuration.
Step 7	profile packet Example: <code>Device(config-ip-sla-service-performance)# profile packet</code>	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 8	default exit no packet-size source-ip-addr Example: <code>Device(config-ip-sla-service-performance-measurement)# throughput</code>	<p>Specifies the measurement type based on which the service performance is calculated. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its default values. • exit - Exits 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: <code>config-ip-sla-service-performance)# measurement-type direction internal</code>	Specifies the direction of measurement.
Step 10	default exit loss throughput receive Example: <code>Device(config-ip-sla-service-performance-measurement)# throughput</code>	<p>Specifies the measurement type based on which the service performance is calculated. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its default values.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>sla_id</i> 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 <i>dest-ip-addr {interface interface interface interface [service instance efp-id vrf vrf_id]}</i> Example: <pre>Device(config-ip-sla)# service-performance type ip dest-ip 194.168.1.1 interface gigabitEthernet0/0/10 service instance 10</pre>	<p>Specifies the service performance type as IP and the destination IP address.</p> <p>Specifies the target for the SLA session. The options are:</p> <ul style="list-style-type: none"> • service instance • interface • vrf
Step 5	frequency iteration number delay number Example: <pre>Device(config-ip-sla)# frequency iteration 1 delay 2</pre>	Specifies the number of interactions and delay between the iteration.
Step 6	duration time seconds Example: <pre>Device(config-ip-sla)# duration time 30</pre>	Sets the service performance duration configuration.
Step 7	profile packet Example: <pre>Device(config-ip-sla-service-performance)# profile packet</pre>	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: <pre>Device(config-ip-sla-service-performance-packet)# src-ip-addr 193.168.1.1</pre>	<p>Specifies the packet type. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults. • exit - Exits 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. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>

	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	<p>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.</p> <ul style="list-style-type: none"> • 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 mnemonic name for a commonly used value. • transmit - Sends the packet without altering it. This is the default value. <p>Note This command is required to configure the rate step kbps command.</p> <ul style="list-style-type: none"> • 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
		<ul style="list-style-type: none"> • rate step pps - Specifies the transmission rate in pps. The rate-step range is from 1 to 1000000 (1 pps to 1000000 pps). <p>Note The rate-step kbps pps number is mandatory for traffic generation.</p>
Step 11	measurement-type direction internal conform-color dscp <i>dscp_value</i> exceed-color dscp <i>dscp_value</i> Example: <pre>Device(config-ip-sla-service-performance)# measurement-type direction internal conform-color dscp af43 exceed-color dscp af41</pre>	Specifies the direction of measurement.
Step 12	default exit loss no throughput receive delay jitter	<p>Specifies the measurement type based on which the service performance is calculated. The options are:</p> <ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>sla_id</i> 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 <i>dest_ip_addr</i> {interface <i>interface</i> interface <i>interface</i> [service instance <i>efp-id</i>] vrf <i>vrf_id</i>} 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: <ul style="list-style-type: none"> service instance interface vrf
Step 5	frequency iteration <i>number</i> delay <i>number</i> Example: Device(config-ip-sla)# frequency iteration 1 delay 2	Specifies the number of interactions and delay between the iterations.
Step 6	duration time <i>seconds</i> Example: Device(config-ip-sla)# duration time 30	Specifies the time period to send packets.

	Command or Action	Purpose
Step 7	profile packet Example: <pre>Device(config-ip-sla-service-performance)# profile packet</pre>	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: <pre>Device(config-ip-sla-service-performance-packet)#packet-size imix</pre>	<p>Specifies the packet type. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults. • exit - Exits 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. <p>Note For IMIX, the packet-size should be explicitly mentioned as IMIX.</p> <ul style="list-style-type: none"> • source-ip-addr - Specifies the source IP address. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
Step 9	exit Example: <pre>Device(config-ip-sla-service-performance-packet)#exit</pre>	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: <pre>Device(config-ip-sla-service-performance)#profile traffic direction internal Device(config-ip-sla-service-performance-traffic) c)# cir 45000 Device(config-ip-sla-service-performance-traffic) e)# eir 45000 Device(config-ip-sla-service-performance-traffic) c)# conform-color set-dscp-transmit af43 Device(config-ip-sla-service-performance-traffic)</pre>	<p>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.</p> <ul style="list-style-type: none"> • 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
	<pre>c) # exceed-color set-dscp-transmit af41 Device(config-ip-sla-service-performance-traffic)# rate-step kbps 1000</pre>	<ul style="list-style-type: none"> • 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 <i>cos_value</i> - 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. <p>Note This command is required to configure the rate step kbps command.</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults.
Step 11	default or exit or no or rate step kbps	<p>Specifies the traffic type. The options are:</p> <ul style="list-style-type: none"> • 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
```


Configuration Examples for Configuring Y.1564 to 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.

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. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip sla <i>sla_id</i> 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 <i>dest-ip-addr</i> interface <i>interface</i> 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: <ul style="list-style-type: none"> • service instance • interface • vrf • bridge-domain
Step 5	frequency iteration <i>number</i> delay <i>number</i> Example: Device(config-ip-sla)# frequency iteration 1 delay 2	Specifies the number of interactions and delay between the iteration.
Step 6	loopback direction {<i>internal</i>} Example: Device(config-ip-sla)# loopback direction internal	Configures loopback direction.
Step 7	duration time <i>seconds</i> Example: Device(config-ip-sla)# duration time 30	Specifies the time period to send packets.

	Command or Action	Purpose
Step 8	profile packet Example: <pre>Device(config-ip-sla-service-performance)# profile packet</pre>	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 9	source-ip-addr <i>ip-address</i> outer-vlan <i>vlan-id</i> Example: <pre>Device(config-ip-sla-service-performance-packet)# source-ip-addr 51.1.1.1 Device(config-ip-sla-service-performance-packet)# outer-vlan 301</pre>	<p>Specifies the packet type. The options are:</p> <ul style="list-style-type: none"> • default - Sets a command to its defaults. • exit - Exits the packet mode. • no - Negates a command or set its defaults. • 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. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p>
Step 10	exit Example: <pre>Device(config-ip-sla-service-performance-packet)#exit</pre>	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
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 ip sla st 101** command to verify SADT overhead accounting configuration as follows:

```
Router#show ip sla st 101
IPSLAs Latest Operation Statistics

IPSLA operation id: 101
Type of operation: Ethernet Service Performance
Test mode: Two-way Measurement
Steps Tested (kbps): 500000
Test duration: 30 seconds

Latest measurement: *14:42:45.333 UTC Thu Jan 9 2020
Latest return code: OK

Overall Throughput: 500000 kbps

Step 1 (500000 kbps):
Stats:
```

```

IR(kbps)  FL          FLR      Avail    FTD Min/Avg/Max    FDV Min/Avg/Max
500000    0           0.00%    100.00%  32.96us/196.06us/198.96us  160ns/855ns/163.28us
Tx Packets: 28409091  Tx Bytes: 1875000006
Rx Packets: 28409091  Rx Bytes: 1875000006
Step Duration: 30 seconds

```

Configurable EMIX Packet Size

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 8: Configuring EMIX Frame Size

E M I X Definition	a	b	c	d	e	f	g	h	
EMIX size (in bytes)	64	128	256	512	1024	1280	1518	Service MTU	



Note

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

Configuration Example: Configurable EMIX Packet Size

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 aaabbccu u-value
?
<64-10236> Specify user-defined packet size value

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

```

Verification of EMIX Packet Size Configuration

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	<i>Ethernet service activation test methodology</i>

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