



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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Finding Feature Information

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

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

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 16.12.1, 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 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.

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



Note SADT Internal sessions do not support ASIC-based SAT.

Because they interconnect segments, forwarding devices (switches and routers) and network interface units are the basis of any network. 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.

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.

Prerequisites for IP SLA - Service Performance Testing

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

Scale and Limitations for Configuring IP SLA - Service Performance Operation

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

Table 2: Y.1564 Throughput Measurement for Each Packet Size

Packet Size (Bytes)	Max Rate (kbps)
64	650000
128	820000
256	860000
512	860000
1024	880000
1280	900000
1518	970000
9216	980000



Note Higher order 1-GigabitEthernet ports and 10-GigabitEthernet port could have few packet loss in 9216 packet size. The above measurements are taken with external mode. Measured throughput value could be higher than configured rate upto 2%.

Traffic Generator

- Supports eight simultaneous transmit sessions on device with a maximum rate of 1 Gbps .
- Supports color-blind traffic generation.
- SAT traffic is always generated in a burst.

Default q-limit values are not adequate to handle the burst and thus leading to packet drops. You need to use the **platform qos-qlimit-disable** command to disable q-limit on the router and this would enable dynamic sharing of resources on all ports.

The **platform qos-qlimit-disable** command disables the QoS q-limit functionality and enables the functionality again once the **platform qos-qlimit-disable** command is removed.

Measurement

The default ether-type to configure SAT endpoint is 0x8904. The measurement can only match packets with ether-type of 0x8904.

NCS 520 traffic generation happens with ether-type of 0x8904 by default. The measurement works if the traffic generator is also NCS 520 or its two-way statistics. The measurement cannot be used if there are devices other than NCS 520 on the other side as the traffic generator. Ether-types IPv4 and IPv6 are user configurable option (ether-type) supported. With the configuration set, you can perform measurement of packets from other devices with ether-type as IPv4 or IPv6.

SAT on NCS520 is supported only for Ethernet mode.

Loopback

NCS 520 does not support ethernet loopback or latching loopback.

NCS 520 supports loopback on SAT, and IP SLA configuration itself is used.

Use the **loopback direction** for the session along with packet profile. Source MAC address and destination MAC address are not same for loopback session. If an IP SLA session is configured as loopback mode, then the session should not have measurement or traffic profile parameters, otherwise the configuration fails.

Loopback sessions does not support statistics.

Restrictions for IP SLA - Service Performance Operation

- Layer 3 fields such as IP, DSCP, and Layer 4 ports are not supported as packet parameter.
- Measurement is supported only for throughput and loss. Delay and jitter measurement are not supported.
- Service types are supported only for EFPs and not for bridge-domain and Layer 3 interfaces.
- Maximum number of sessions supported is 8 and these 8 sessions can run simultaneously.
- Color aware statistics is not supported.
- Port-channel testing is not supported.
- When a configuration performed on EFP or interface is shutdown, the packets do not egress out of any interface on the device, and after unshut, the traffic does not resume to egress direction. You need to restart the configuration manually.
- On test EFP or BD removal on the test interface, traffic does not egress out of any of the interfaces in the device, and traffic flow resumes only after reconfiguring. After which, the test is rescheduled.
- Each session should have an unique encapsulation, and if sessions have same encapsulations or match keys might impact the statistics.
- Packets that use SAT internal MAC (0xf244493930ec) as destination MAC addresss and internal VLAN (0xdd4) have problem with forwarding.

- Loopback or measurement with packet size of 1518 at ingress direction does not work. This is due to the extra headers being added at ingress direction. To overcome this, MTU size of the interface has to be increased.
- Span on the SAT configured interface is not supported.
Rx statistics work only after 10 seconds and you need to use the **platform qos-qlimit-disable** command to disable the q-limit on the router before starting the SLA session.
- SLA measurement in 10-Gigabit Ethernet port is supported with maximum rate of 1-Gigabit Ethernet. Higher the order of 1-Gigabit Ethernet ports, 10-Gigabit Ethernet ports have few packets loss for higher packet size.
- Interface statistics and SLA statistics might not match in higher order ports.
- The following table shows the supported egress and ingress QOS on the sender side core interface for Ethernet and IP target SLA.

Table 3: IP SLA and Type of QOS supported

Type	Policy-map at interface (Ingress)	Policy-map at interface (Egress)	Policy-map at EFP (Ingress)	Policy-map at EFP (Egress)
Internal Mode 2-way measurement	Yes	Yes	Yes	Yes
Internal Receive Mode	No	Yes	No	Yes
Internal Loopback Target Interface	Yes	Yes	Yes	Yes
External Mode 2-way measurement	No	No	No	No
External Receive Mode	Yes	No	Yes	No
External Loopback Target Interface	Yes	No	Yes	No



Note Ingress classification does not work for match on VLAN for SADT traffic.

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

Table 4: 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

Generating Traffic Using Y.1564

Follow these steps to generate traffic using Y.1564:

SUMMARY STEPS

1. Configure Ethernet Virtual Circuits (EVC).
2. Configure Traffic Generator on the transmitter.
3. Configure loopback on SAT IP SLA configuration itself at the remote end.
4. Configure loopback on SAT IP SLA configuration itself, if remote end is NCS 520 or use ether-type as IPv4 or IPv6, if remote node is other than NCS520.
5. Start the IP SLA session:

DETAILED STEPS

	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>Direction - External ip sla 200 service-performance type ethernet dest-mac-addr</pre>	

	Command or Action	Purpose
	<pre> 0000.0300.0301 interface GigabitEthernet 0/0/1 service instance 300 frequency iteration 1 delay 1 duration time 50 profile packet inner-cos 5 outer-cos 5 inner-vlan 101 outer-vlan 101 packet-size 256 profile traffic direction external rate-step kbps 50000 Direction - Internal ip sla 200 service-performance type ethernet dest-mac-addr 0000.0300.0301 interface GigabitEthernet 0/0/1 service instance 300 frequency iteration 1 delay 1 duration time 50 profile packet inner-cos 5 outer-cos 5 inner-vlan 101 outer-vlan 101 packet-size 256 profile traffic direction internal rate-step kbps 50000 </pre>	
Step 3	<p>Configure loopback on SAT IP SLA configuration itself at the remote end.</p> <p>Example:</p> <pre> ip sla 1 service-performance type ethernet dest-mac-addr 0001.0001.0001 interface GigabitEthernet0/0/3 service instance 2 loopback direction external profile packet inner-vlan 20 outer-vlan 10 src-mac-addr 0002.0002.0002 duration time 5000 </pre>	
Step 4	<p>Configure loopback on SAT IP SLA configuration itself, if remote end is NCS 520 or use ether-type as IPv4 or IPv6, if remote node is other than NCS520.</p>	
Step 5	<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>	

How to Configure IP SLA - Service Performance Testing

Y.1564 support on dot1ad Encapsulation

Table 5: Feature History

Feature Name	Release Information	Feature Description
Y.1564 support on dot1ad	Cisco IOS XE Cupertino 17.8.1	<p>This feature enables Y.1564 Ethernet service activation test methodology support on interfaces that are configured with 802.1ad encapsulation. It allows you to perform medium-term and long-term service testing, confirming that the interfaces that are configured with 802.1ad can properly carry all services while under stress during a soaking period.</p> <p>The following commands are introduced:</p> <ul style="list-style-type: none"> - inner-eth-type - outer-eth-type

Configuring Ethernet Target Two-Way Color Blind Session

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

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sla *sla_id***
4. **service-performance type ethernet dest-mac-addr *dest-mac* service instance**
5. **aggregation | default | description | duration | exit | frequency | no | profile**
6. **measurement-type direction {internal | external}**
7. **default | exit | no | throughput | receive**
8. **exit**
9. **profile packet**
10. **default | exit | inner-cos | inner-vlan | no | outer-cos | outer-vlan | packet-size | src-mac-addr | outer-eth-type | inner-eth-type**
11. **exit**
12. **profile traffic direction {external | internal}**
13. **default or exit or no or rate step kbps | pps**

14. exit

DETAILED STEPS

	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</i> service instance Example: Device(config-ip-sla)#service-performance type ethernet dest-mac-addr 0001.0001.0001 interface gigabitEthernet0/10 service instance 10	Specifies the service performance type as Ethernet and the destination MAC address in H.H.H format. Specifies the target for the SLA session. The options is service instance.
Step 5	aggregation default description duration exit frequency no profile Example: Device(config-ip-sla-service-performance)# duration time 60	Specifies the type of service performance. The options are: <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: Device(config-ip-sla-service-performance)# measurement-type direction	Specifies the statistics to measure traffic. The options available are external or internal; the default option is internal. Only external measurement-type direction is supported for 10G.
Step 7	default exit no throughput receive Example:	Specifies the measurement type based on the service performance is calculated. The options are:

	Command or Action	Purpose
	Device (config-ip-sla-service-performance-measurement) # throughput	<ul style="list-style-type: none"> • default - Sets a command to its defaults. • throughput - Specifies the measurement such as average rate of successful frame delivery. • receive - Specifies the passive measurement mode.
Step 8	exit	Exits the measurement mode.
Step 9	profile packet Example: Device (config-ip-sla-service-performance) #profile packet	Specifies the packet profile. A packet profile defines the packets to be generated.
Step 10	default exit inner-cos inner-vlan no outer-cos outer-vlan packet-size src-mac-addr outer-eth-type inner-eth-type Example: Device (config-ip-sla-service-performance-packet) #src-mac-addr 4055.3989.7b56	<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 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, and 9216 bytes. • src-mac-addr - Specifies the source MAC address in H.H.H format. • outer-eth-type - Specifies the encapsulation type for the outer VLAN tag of the packet as dot1ad or dot1q. • inner-eth-type - Specifies the encapsulation type for the inner VLAN tag of the interface from which the message is sent as dot1ad or dot1q. <p>Note Ensure that the value of the configured packet profile matches the target configuration of the session.</p> <p>Note If you do not specify the encapsulation type in the packet profile, dot1q is used by default.</p>

	Command or Action	Purpose
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. 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.

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

This section shows sample configurations for traffic generation.

Example: Traffic Generation

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

```

Direction - External
ip sla 200
service-performance type ethernet dest-mac-addr 0000.0300.0301 interface GigabitEthernet
0/0/1 service instance 300
frequency iteration 1 delay 1
duration time 50
profile packet
inner-cos 5
outer-cos 5
inner-vlan 101
outer-vlan 101
packet-size 256

```

```

profile traffic direction external
rate-step kbps 50000
Direction - Internal
ip sla 200
service-performance type ethernet dest-mac-addr 0000.0300.0301 interface GigabitEthernet
0/0/1 service instance 300
frequency iteration 1 delay 1
duration time 50
profile packet
inner-cos 5
outer-cos 5
inner-vlan 101
outer-vlan 101
packet-size 256
profile traffic direction internal
rate-step kbps 50000

```

Example: Two-Way Session

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

Two-way measurement mode: Direction - Internal

```

ip sla 12345
service-performance type ethernet dest-mac-addr 00ab.cdef.1234 interface
TenGigabitEthernet0/0/4 service instance 1000
measurement-type direction internal
receive
throughput
profile packet
outer-cos 2
outer-vlan 999
packet-size 1518
src-mac-addr 0012.3456.789a
profile traffic direction internal
rate-step kbps 10000 15000
duration time 100

```

Two-way measurement mode: Direction - External

```

ip sla 12345
service-performance type ethernet dest-mac-addr 00ab.cdef.1234 interface
TenGigabitEthernet0/0/4 service instance 1000
measurement-type direction external
receive
throughput
profile packet
outer-cos 2
outer-vlan 999
packet-size 1518
src-mac-addr 0012.3456.789a
profile traffic direction external
rate-step kbps 10000 15000

```

Example: Passive Measurement Mode

The following is a sample configuration for passive measurement session.

Direction - External

```

ip sla 200
service-performance type ethernet dest-mac-addr 0000.0300.0301 interface GigabitEthernet
0/0/11 service instance 300
measurement-type direction external
receive
profile packet
inner-cos 5
outer-cos 5
inner-vlan 101
outer-vlan 101
packet-size 256

```

Direction - Internal

```

ip sla 200
service-performance type ethernet dest-mac-addr 0000.0300.0301 interface GigabitEthernet
0/0/11 service instance 300
measurement-type direction internal
receive
profile packet
profile packet
inner-cos 5
outer-cos 5
inner-vlan 101
outer-vlan 101
packet-size 256

```

Example: Two-Way Measurement Mode

The following is a sample loopback configuration for a two-way measurement mode.

Direction - External:

```

ip sla 200
service-performance type ethernet dest-mac-addr 0000.0300.0301 interface GigabitEthernet
0/0/11 service instance 300
measurement-type direction external
receive
profile packet
inner-cos 5
outer-cos 5
inner-vlan 101
outer-vlan 101

```

Direction - Internal:

```

ip sla 200
service-performance type ethernet dest-mac-addr 0000.0300.0301 interface GigabitEthernet
0/0/11 service instance 300
measurement-type direction internal
receive
profile packet
profile packet
inner-cos 5
outer-cos 5

```

```
inner-vlan 101
outer-vlan 101
```

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

