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With the deployment of Ethernet in service provider networks, ethernet services have evolved significantly. Not only is ethernet found at the User Network Interface (UNI) but can also be deployed anywhere in the network, creating a Network-to-Network Interface (NNI). With the capability to prioritize traffic, high availability, and its built-in resiliency, service providers are now using this technology to deliver advanced services. In the absence of any standardized test methodologies that can measure delay, jitter, loss, and throughput at a port, the ITU-T recommendation Y.1564 addresses the gap

Y.1564 - Ethernet Service Activation Test (or performance test methodology) is a testing procedure which tests service turn-up, installation, and troubleshooting of Ethernet-based services. This test methodology was created to have a standard way of measuring Ethernet-based services in the industry.

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

- To serve as a network SLA validation tool, ensuring that a service meets its guaranteed performance settings in a controlled test time.

- To ensure that all services carried by the network meet their SLA objectives at their maximum committed rate, thus proving that under maximum load, network devices and paths can support all traffic as designed.

- To perform medium-term and long-term service testing, confirming that network elements can properly carry all services while under stress during a soaking period.

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

- Frame Transfer Delay (FTD) or latency—Measures the round-trip time (RTT) taken by a test frame to travel through a network device, or across the network and back to the test port.

- Frame Loss Ratio (FLR)—Measures the number of packets lost from the total number of packets sent. Frame loss can be due to a number of issues such as network congestion or errors during transmissions.

Supported Modes

The mode of operation that is supported for Y.1564 is the Two-way statistics collection mode. In the two-way mode, the sender generates the test traffic used to perform the test, which is then looped back by the remote node. The statistics are measured and collected locally on the sender

The following encapsulations are supported by Y.1564 SADT feature:

- dot1q
- dot1q + second dot1q
- dot1ad
- dot1ad + second dot1q
- priority tagged
- untagged
- default

Note Before Cisco IOS XR Software Release 24.2.1, default encapsulation is supported if there are no other subinterfaces configured with untagged encapsulation. Starting Cisco IOS XR Software Release 24.2.1, default encapsulation is supported.

Usage Guideline and Limitations

- Rewrite with POP option is supported with Color Blind mode with Outer-Cos value of 0.
- Rewrite Push and Translate on Encapsulation Untagged is not supported.
- Y.1564 doesn't support L1 loopback.
- Y.1564 doesn't support measuring and analyzing jitter.
- When utilizing the SAT engine received bytes statistics feature, there can be potential inaccuracies in the following conditions:
    - During tests incorporating EMIX sequences that encounter packet drops.
    - When handling LMM packets originating from TGEN, Y.1731 protocols, or any unidentified sources.
- SAT supports a scale of four parallel sessions per system. However, all four sessions can not operate as color aware sessions simultaneously due to limitations in Class of Service (CoS) combinations.
- SAT over bundle interface functions by selecting one of its members for transmission. Therefore, at least one member must be in the 'UP' state to initiate an SAT session. For modular chasis, bundle member from the different LCs is not supported.
- For optimal performance, it's recommended to use the Ethernet Data Plane Loopback functionality (EDPL) on the peer side for SAT. EDPL loops back and swaps the MAC addresses of Layer 2 packets generated. If the peer node doesn't support EDPL functionality, you can configure SAT to generate Layer 2 packets with the destination MAC address equal to the source MAC address. In such cases, the peer can perform an L1 loopback.

- Packets generated by SAT with PRBS payload at certain packet sizes may have PRBS errors. When configuring GTF packet using bcm_sat_gtf_packet_config_set, this is verified. If the payload_type is bcmSatPayloadPRBS and packets generated at the configured packet_length have PRBS error, this API now returns BCM_E_PARAM to the caller. The user is informed about the PRBS error through the test abort reason.

    - On BCM8869X, packets have PRBS errors, if (packet_length + 63) / 64 is one of [4, 6, 10, 12, 13, 14] or $>= 18$.

    - On BCM8880X, packets have PRBS errors, if (packet_length + 63) / 64 equals to 6 or $>= 33$.

Platform GTF Rate

The following table includes the GTF rate for different platforms.

Platform (PID)	Platform Name	Asic Type	XR Release	DTHO	GTF Rate
NCS540	Tortin	QAX	7.1.1	Yes	19.2 Gbps
NCS560	RSP4	QMX	7.1.2	Yes	19.2 Gbps
NCS540L	Bigbend	QAX	7.1.2	Yes	19.2 Gbps
NCS4K	Scapa	Arad	6.5.31	Yes	23 Gbps
NCS5501	Taihu	QMX	7.1.1	Yes	19.2 Gbps
NCS-5501-SE	Turin	QMX	7.1.1	Yes	19.2 Gbps
NCS55A1-48Q6H	BiFrost	Jericho+	7.1.2	Yes	23 Gbps
NCS55A2_MOD_S_SE	Peyto	Jericho+	7.1.2	Yes	23 Gbps
NCS-55A1-36H-SE-S	Old Castle	Jericho+	7.4.2	No	23 Gbps
NCS-55A1-36H-S	Old Castle CR (non-SE)	Jericho+	7.4.2	No	23 Gbps
NCS-55A1-24Q6H-S	TurinCR	Jericho+	7.1.1	No	23 Gbps
NCS-55A1-24Q6H-SS	TurinCR MACsec	Jericho+	7.1.1	No	23 Gbps
NCS-55A1-24H	Pyke	Jericho+	7.1.1	No	23 Gbps

NCS-5502-SE	Zermatt	Jericho	7.1.1	No	23 Gbps
N540X-6Z18G-SYS-A	Beagle	QUX	7.3.1	No	8 Gbps
N540X-4Z14G2Q-D	Fitzroy	QUX	7.3.1	No	8 Gbps
N540X-8Z16G-SYS-D	Galapagos	QUX	7.3.1	No	8 Gbps
N540-6Z14S-SYS-D	Meerkat	QUX	7.3.1	No	8 Gbps
NCS-57C1-48Q6-SYS	Twins	Q2C	7.8.1	Yes	300 or 400 Gbps
NCS-57C3-MODS-SYS	Eyrie	Jericho2C	7.8.1	Yes	400 Gbps
NCS-57B1-5DSE-SYS	Shadow Tower	Jericho2	7.8.1	Yes	400 Gbps
N540-24Q8L2DD-SYS	Arches	Q2A	7.8.1	Yes	300 Gbps
NCS-57D2-18DD-SYS	CastleBlack	Jericho2C+	Future Release	No	400 Gbps

CoS DEI Support Matrix

Table 1: Class of Service (CoS) and Discard Eligibility Identifier (DEI) Matrix

		CoS							
		0	1	2	3	4	5	6	7
DEI	0	Ö	Ö	Ö	Ö	Ö	X	Ö	X
	1	Ö	Ö	X	X	X	X	X	X

Ö - Supported

X- Not Supported

Supported Bandwidth Parameters

Bandwidth Parameters	Internal Direction	External Direction
Commited Information Rate	Y	Y
Exceeded Information Rate	Y	Y

Service Activation Test Target Matrix

Target	Internal Direction	External Direction
L2 Interface over physical main/sub interfaces	Y	Y
L2 Interface over bundle main/sub interfaces	Y	Y
L2 PW VPWS over physical main/sub interfaces	Y	Y
L2 PW VPWS over bundle main/sub interfaces	Y	Y
L2 EVPN/XConnect over physical main/sub interfaces	Y	Y
L2 EVPN/XConnect over bundle main/sub interfaces	Y	Y
L2 VPLS PW	N	N
L2 EVPN Bridge-Domain	N	N
L3 Interfaces	N	N

Configuration Examples

The following example shows how to start service-activation test on an interface with external direction:

```
RP/0/RP0/CPU0:router ethernet  service-activation-test start interface TenGigE 10/0/0/1
profile test destination 00ab.6009.9c3c direction external
```

The following example shows how to start service-activation test on an interface with internal direction:

```
RP/0/RP0/CPU0:routerethernet  service-activation-test start interface TenGigE 10/0/0/1
profile test destination 00ab.6009.9c3c direction internal
```

The following example shows how to stop service-activation-test on an interface:

```
RP/0/RP0/CPU0:routerethernet service-activation-test stop interface TenGigE 10/0/0/1
```

The following example shows how to stop all service-activation-tests:

```
RP/0/RP0/CPU0:routerethernet service-activation-test stop all
```

Configuring Ethernet Service Activation Test Color Profile

The following example shows how to configure a color-blind profile for ethernet service activation test:

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)# ethernet service-activation-test
RP/0/RP0/CPU0:router(config-ethsat)#profile sattest1
RP/0/RP0/CPU0:router(config-ethsat-prf)#outer-cos 4
```

```
RP/0/RP0/CPU0:router(config-ethsat-prf)#duration 8 minutes
RP/0/RP0/CPU0:router(config-ethsat-prf)#information-rate 11800 mbps
RP/0/RP0/CPU0:router(config-ethsat-prf)#packet-size 1000
```

The following example shows how to configure a color-aware profile for ethernet service activation test:

```
RP/0/RP0/CPU0:router#configure
RP/0/RP0/CPU0:router(config)# ethernet service-activation-test
RP/0/RP0/CPU0:router(config-ethsat)#profile sattest3
RP/0/RP0/CPU0:router(config-ethsat-prf)#outer-cos 4
RP/0/RP0/CPU0:router(config-ethsat-prf)#duration 1 minutes
RP/0/RP0/CPU0:router(config-ethsat-prf)#color-aware cir 7 gbps eir-color cos 1
RP/0/RP0/CPU0:router(config-ethsat-prf)#information-rate 8 gbps
RP/0/RP0/CPU0:router(config-ethsat-prf)#packet-size 1000
```

Verification

To verify the interfaces on which Y.1564 (ethernet service activation test) is enabled, use the **show ethernet service-activation-test brief** command. The following is a sample output of an enabled device:

```
RP/0/RP0/CPU0:router#show ethernet service-activation-test brief
Interface TenGigE0/0/0/14.1
  Service activation tests permitted (external only)
  Test completed:
    Duration 1 minute(s)
    Information rate 1 Gbps
    Color-aware, CIR: 900 Mbps, EIR: DEI set, CoS 1
    External, Two-way, Destination 00:11:00:22:00:33
    Packet size EMIX, Sequence 'abceg', Pattern hex 0x00
    Packet format: SAT MEF-49
    Outer CoS 2

  Results:
    Step 1, Information Rate 1 Gbps
      CIR packets:
        Tx packets: 11276845, bytes: 6743553310
        Rx packets: 11276845, bytes: 6743553310
        FL: 0, FLR: 0%
        FD: Min 5.144us, Mean 6.681us, Max 9.576us
        IFDV: Not supported
        Out of order packets: 0 (0%)
        Error packets: 0 (0%)

      EIR packets:
        Tx packets: 1252895, bytes: 749231210
        Rx packets: 1252895, bytes: 749231210
        FL: 0, FLR: 0%
        FD: Min 5.160us, Mean 6.679us, Max 8.800us
        IFDV: Not supported
        Out of order packets: 0 (0%)
        Error packets: 0 (0%)
```

Optional Source MAC Address for Y.1564 Service Activation Test

Table 2: Feature History Table

Feature Name	Release Information	Feature Description
Optional Source MAC Address for Y.1564 Service Activation Test	Release 24.1.1	Introduced in this release on: NCS 5500 fixed port routers; NCS 5700 fixed port routers By specifying the source MAC address to the ITU-T Y.1564 SAT, you can ensure that the test results are relevant and applicable to the specific service configuration for use in production and before deployment for your customers. This feature introduces the following change: **Modified CLI:** The **source** keyword is added to the **ethernet service-activation-test** command. **YANG DATA Model**: • New XPaths for Cisco-IOS-XR-ethernet-sat-act.yang (see Github, YANG Data Models Navigator)

Prior to Cisco IOS XR Software Release 24.1.1, the default local interface MAC address was automatically employed as the source MAC address for the test traffic. This approach lacked flexibility and customization options, as you were restricted to the default address. With the optional source MAC address extension, you can specify the exact source MAC address you wish to use in the test traffic. This functionality empowers you to tailor the test sessions according to your specific requirements and network configurations.

Add Source MAC Address for a Y.1564 Service Activation Test

Use the **source** keyword in the **ethernet service-activation-test** command to specify a source MAC address for a Y.1564 Service Activation Test.

Procedure

Step 1   Use the **ethernet service-activation-test** command to configure a profile.

```
Router(config)#ethernet service-activation-test
Router(config-ethsat)#profile prof1
Router(config-ethsat-prf)#duration 1 minutes
Router(config-ethsat-prf)#information-rate 1 mbps
Router(config-ethsat-prf)#root
Router(config)#interface TenGigE0/0/0/1
Router(config-if)#ethernet service-activation-test
Router(config-if-ethsat)#permit all
Router(config-if-ethsat)#commit
```

Step 2 Run the **ethernet service-activation-test** command in exec mode to specify source MAC address for an SAT:

```
Router#ethernet service-activation-test start interface TenGigE0/0/0/1 profile prof1
destination 00ab.6009.9c3c source 0000.1000.001d direction external
```

Step 3 The **show ethernet service-activation-test in-progress** command displays the source MAC address.

```
Router#show ethernet service-activation-test in-progress
Fri Oct 21 03:50:55.658 PDT
Interface TenGigE0/0/0/1
  Service activation tests permitted
  Test in progress, 1 minute(s) remaining:
    Duration 1 minute(s)
    Information rate 1 Mbps
    External, Two-way, Destination 00ab.6009.9c3c, Source 0000.1000.001d
```