Agenda

- Issues with current methodologies and new testing trends
- Description of Y.156SAM Methodology
- What is EtherSAM
- Advantages of EtherSAM
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- What is EtherSAM
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Classic SLA Performance Assessment: RFC 2544 Test methodology

- RFC = “Request for Comment”, created by the Internet Engineering Task Force
- (Title: “Benchmarking Methodology for Network Interconnect Devices”)
- Evolved to provide performance metrics of Ethernet networks
- Four tests applicable to Ethernet networks
- Allows Control of Frame Sizes (Sweep), Duration and number of test iterations

Throughput  Latency  Back-to-Back (Burstability)  Frame Loss
Issues with RFC 2544 Test Methodology

- Tests are done sequentially
- Methodology is performance-based…
  - Does not transition well to a mid to long-term measurement
- Traffic generation based on single stream of test data
  - Not scalable to multiple class of services as defined in MEF 6.1 and 10.1
- Packet jitter is not defined in this test; this is a key component of new Ethernet services SLAs:
  - Mobile backhaul - SyncE capable
  - Triple-Play (xDSL, FTTx) networks
  - Business services (mission critical operations)
- Convergence of tests are long and unpredictable (from 20min to ~4hr for full suite of tests)
- Pass/fail results are left to interpretation
Issues with today’s Ethernet testing methodologies

- Only currently standardized methodology is RFC2544
- Current methodology (RFC2544) does not include all required measurements for today’s services (SLA parameters):
  - Packet Jitter, Out-of-Sequence, QoS measurement, multiple concurrent service levels.
- Need to perform multiple tests to validate complete SLA.
  - One RFC per Service or CoS
  - Then one test with streams – Multi-Stream
- Current methodology is time consuming (approx. 4 hours)
- Current methodology does not adapt to long term measurements

Y.156SAM addresses all these issues
Applications

Mobile Backhauls services

- 3G has 4 Classes of service defined
- LTE (4G) has 7 classes of service defined

<table>
<thead>
<tr>
<th>LTE traffic</th>
<th>Transport Service Class</th>
<th>PCP</th>
<th>DSCP</th>
<th>LTE Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronization</td>
<td>Synchronization</td>
<td>7</td>
<td>111xxx</td>
<td>Sync</td>
</tr>
<tr>
<td>Bearer OAM</td>
<td>Bearer OAM</td>
<td>4</td>
<td>100xxx</td>
<td>OAM</td>
</tr>
<tr>
<td>QCI Level 1/2</td>
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<td>S1, X2</td>
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<tr>
<td>QCI Level 5</td>
<td>Control/Management</td>
<td>7</td>
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<td>S1, X2</td>
</tr>
<tr>
<td>Others</td>
<td>0, 1, 2</td>
<td>001xxx-01xxx</td>
<td>S1, X2</td>
<td></td>
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</table>

Commercial Services, Wholesale Services

<table>
<thead>
<tr>
<th>Performance Attribute</th>
<th>Real Time</th>
<th>High Priority Data</th>
<th>Best Effort Data (Internet Access)</th>
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<tbody>
<tr>
<td>CIR (Mbps) (Green Traffic)</td>
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**Useful Definitions**

**CIR:** Committed Information Rate: Average rate in bits/s of Service Frames up to which the network delivers Service Frames and meets the performance objectives defined by the CoS Service Attribute.

**EIR:** Excess Information Rate: Average rate in bits/s of Service Frames up to which the network may deliver Service Frames but without any performance objectives.

**Traffic Color Awareness**

- **Dropped bandwidth (everything over EIR)**
- **Best Effort bandwidth (everything between CIR and EIR)**
- **Guaranteed bandwidth (everything under CIR)**
### Ethernet Service SLA Example

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This is what needs to be validated when the service is turned up.
End-to-end Service with SLA:

- Traffic shaping configured in network equipment **according to SLA** (Rate limitation, queuing)
- Decision made on frame configuration: VLAN, ToS/DiffServ, port

<table>
<thead>
<tr>
<th>Performance Metric</th>
<th>Customer Site</th>
<th>End-to-end</th>
<th>Edge Site</th>
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1. Need to perform complete RFC2544 for Real Time service **(4 hours)**

2. Need to perform complete RFC2544 for High Priority Data **(4 hours)**

3. Need to perform complete RFC2544 for Best Effort Data **(4 hours)**

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**Can be verified with RFC2544**

**Cannot be verified with RFC2544**

*With RFC2544 Service Validation takes 16 hours and not all parameters are verified*
Issues with current methodologies and new testing trends
Description of Y.156SAM Methodology
What is EtherSAM
Advantages of EtherSAM
Following a large number of complaints from customers that RFC2544 was a very long procedure and not adapted to the services they needed to turn-up and troubleshoot, EXFO approached ITU-T for developing a new methodology.

- This methodology was first validated with different international Service Providers.
- The validated methodology was then proposed to the ITU-T and accepted. It is now an official draft recommendation: **Y.156sam**
- Study Group 12 is working on it.
High-Level View of Y.156SAM Test Methodology

ITU-T Y.156SAM (EtherSAM)

Phase 1 – Network Configuration Test (Ramp Test)

**Objective:** Validate the network configuration of each defined services (rate limiting, traffic shaping, QoS)

**Methodology:** For each service, a ramp test is used to gradually reach and exceed the CIR. All KPIs are measured against a threshold

Phase 2 – Service Test

**Objective:** Validate the quality of service of each defined service and prove SLA conformance

**Methodology:** All services are generated at once to their CIR and all KPIs are measured for all services
## Ethernet Service SLA Example

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<td>&lt;0.05</td>
<td>&lt;0.05</td>
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<tr>
<td>Restoration Time (sec)</td>
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<td>0.2</td>
<td>0.2</td>
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Phase 1 – Network Configuration Test

**Objective:** Validate the network configuration of each defined services (rate limiting, traffic shaping, QoS)

**Methodology:** For each service, a ramp test is used to gradually reach and exceed the CIR. All KPIs are measured against a threshold.

Ramp repeated for each service

- **CIR**
- **EIR**

1-10 sec per step

All SLA parameters measured at each step (Throughput, Latency, Frame Loss, Jitter, OOS), Pass/Fail result

For each service sequentially, generate a traffic ramp, first up to CIR and then up to EIR (if applicable) and then over EIR

- Verify that CIR and EIR are properly configured
- Verify all SLA parameters at each ramp step (Pass/Fail thresholds for each parameters)
- Approximate Test time: 1 minute per service
Generate all Services simultaneously at CIR and measure all parameters simultaneously (Throughput, Latency, Frame Loss and Packet Jitter) – Similar to “Per Stream Statistics”

- Pass/Fail threshold for each parameter (in each direction)
- Suggested Test time: 2 hours (dependent on customers, could be as low as 2 minutes)
- Can be scaled to longer term test (ex. 24 hours).
Issues with current methodologies and new testing trends

Description of Y.156SAM Methodology

What is EtherSAM

Advantages of EtherSAM
EtherSAM: Ethernet Service Activation Methodology

- EXFOs application for ITU-T draft recommendation: Y.156sam
- New test methodology for Ethernet Services (outdates the RFC2544).
  - To be used for service turn-up and troubleshooting of Ethernet Commercial Services, Ethernet Mobile Backhaul Services, Ethernet Wholesale services
- Key functionality:
  - Test methodology to validate the key performance indicator of Carrier Ethernet-based services
    - Validates the configuration of each defined service
    - Validates the quality of the services as defined in the Service Level Agreement

EXFO first to implement Y.156sam with EtherSAM
Bi-directional (Dual Test Set)

As per RFC2544, we can perform the EtherSAM in Dual Test Set and obtain Bi-Directional Results

- Customer quote: “With Dual Test Set, we find about 5% more configuration errors”
- Only Bi-directional results can uncover all configuration errors and test assymmetrical services
- Results available at both Testers
## EtherSAM USPs and messaging

### Advantages

- Methodology completely adapted to today’s Ethernet services:
  - Addressing all key SLA parameters: Throughput, Frame Loss, Latency, Jitter, Out-of-Sequence for multiple services simultaneously
- Test is much faster than RFC2544
  - Results for several test steps on one report
- Bi-directional results for all services (based on Dual Test Set)
  - Test can be transitioned to long term (ex. 24h)
- Standards-based

### What’s in it for the Customer

- Validate complete SLA with a **SINGLE TEST**
  - Optimized quality of service
- Turn-up is **8x faster** than RFC2544 (based on connection with 4 classes of service)
  - **Significant OPEX reduction**
- **First time right**
- Feeling of confidence
- **Credibility** when facing end customer
EXFO revolutionizes Carrier Ethernet/Mobile Backhaul service turn-up and troubleshooting with first Y.156sam implementation.

- EXFO is the first to implement this new standard by the ITU
- New standard is the only one that is adapted to today’s reality for Carrier Ethernet Services
- ITU standards are endorsed by worldwide major Service Providers and NEMs
- Implementation with Patent pending methodology with bi-directional results
Questions?
Thank You