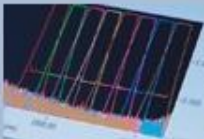


Arthur Moll
BDM
Transport and Datacom

May 2010

Introducing EtherSAM

Ethernet Service Activation Methodology



Design



Deployment



Service Assurance

EXFO

EXPERTISE REACHING OUT

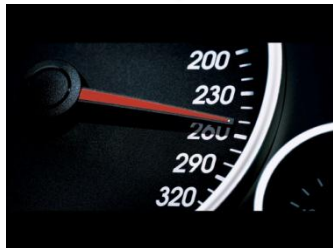
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- **Issues with current methodologies and new testing trends**
- **Description of Y.156SAM Methodology**
- **What is EtherSAM**
- **Advantages of EtherSAM**

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Classic SLA Performance Assessment: RFC 2544 Test methodology

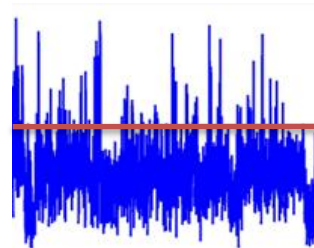
- RFC = “Request for Comment”, created by the Internet Engineering Task Force
- (Title: “*Benchmarking Methodology for Network Interconnect Devices*”)
- Evolved to provide performance metrics of Ethernet networks
- Four tests applicable to Ethernet networks
- Allows Control of Frame Sizes (Sweep), Duration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



Frame Loss



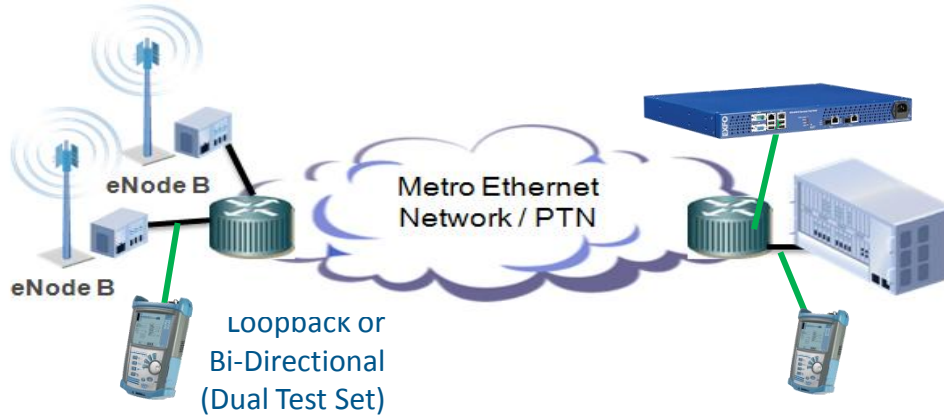
Packet Jitter

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

Mobile Backhuls services



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

LTE traffic	Transport Service Class	PCP	DSCP	LTE Interface	
Synchronization	Synchronization	7	111xxx	Sync	
Bearer OAM	Bearer OAM	4	100xxx	OAM	
QCI Level	1/2	Voice/Live Video	6	110xxx	S1, X2
	3	Video on Demand	3	011xxx	S1, X2
	4	Real Time Gaming	5	101xxx	S1, X2
	5	Control/Management	7	111xxx	S1, X2
	6/7/8/9	Others	0,1,2	000xxx-010xxx	S1, X2

Commercial Services, Wholesale Services



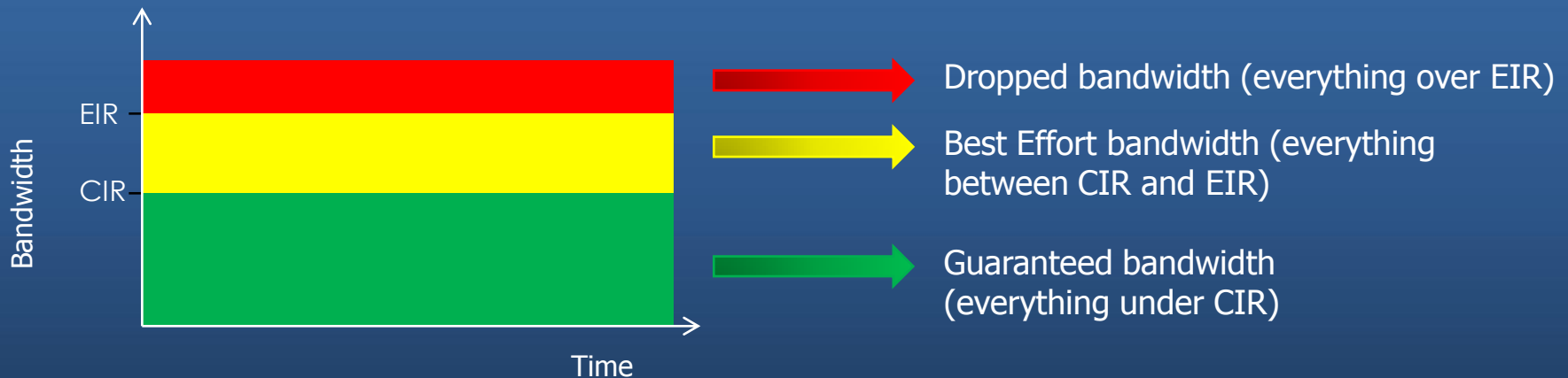
Performance Attribute	Real Time	ORACLE High Priority Data	Best Effort Data (Internet Access)
CIR (Mbps) (Green Traffic)	5	10	2.5
EIR (Mbps) (Yellow Traffic)	0	5	5
Frame Delay (ms)	<5	5-15	<30
Frame Delay Variation (ms)	<1	n/a	n/a
Frame Loss (%)	<0.001	<0.05	<0.05
VLAN	100	200	300

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.

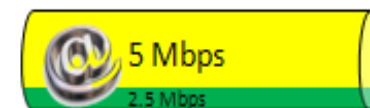
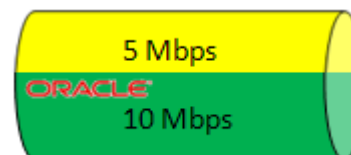
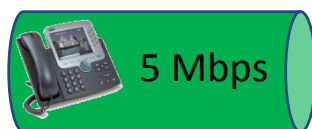
EIR: Excess Information Rate: Average rate in bits/s of Service Frames up to which the network may deliver Service Frames but without any performance objectives.

Traffic Color Awareness



Ethernet Service SLA Example

Performance Attribute	 Real Time	ORACLE [®] High Priority Data	 Best Effort Data (Internet Access)
CIR (Mbps) (Green Traffic)	5	10	2.5
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Frame Loss (%)	<0.001	<0.05	<0.05
VLAN	100	200	300



This is what needs to be validated when the service is turned-up

Ethernet Commercial Services



End-to-end Service with SLA:

Performance Attribute	Real Time	ORACLE [®] High Priority Data	Best Effort Data (Business As Usual)
CIR (Mbps) (Green Traffic)	5	10	2.5
EIR (Mbps) (Yellow traffic)	0	5	5
Frame Delay (ms)	<5	5-15	<30
Frame Delay Variation (ms)	<1	n/a	n/a
Frame Loss (%)	<0.001	<0.05	<0.05
VLAN	100	200	300


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



If you need to test this service with RFC2544

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)

Performance Attribute	Real Time	ORACLE High Priority Data	Best Effort Data (Internet Access)
CIR (Mbps) (Green Traffic)	5	10	2.5
EIR (Mbps) (Yellow Traffic)	0	5	5
Frame Delay (ms)	<5	5-15	<30
Frame Delay Variation (ms)	<1	n/a	n/a
Frame Loss (%)	<0.001	<0.05	<0.05
VLAN	100	200	300

 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
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Y.156sam History

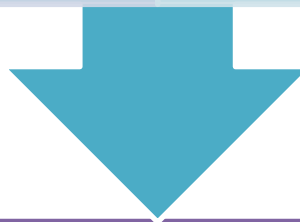
- Following a large number of complaints from customers that RFC2544 was a very long procedure and not adapted to the services they needed to turn-up and troubleshoot, EXFO approached ITU-T for developing a new methodology
- This methodology was first validated with different international Service Providers
- 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.

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






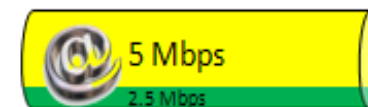
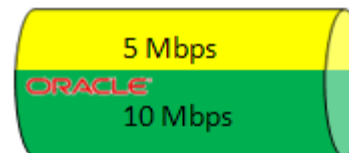
Phase 2 – Service Test

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

Performance Attribute	 Real Time	 High Priority Data	 Best Effort Data (Internet Access)
CIR (Mbps) (Green Traffic)	5	10	2.5
EIR (Mbps) (Yellow Traffic)	0	5	5
Frame Delay (ms)	<5	5-15	<30
Frame Delay Variation (ms)	<1	n/a	n/a
Frame Loss (%)	<0.001	<0.05	<0.05
Restoration Time (sec)	0.2	0.2	0.2
VLAN	100	200	300

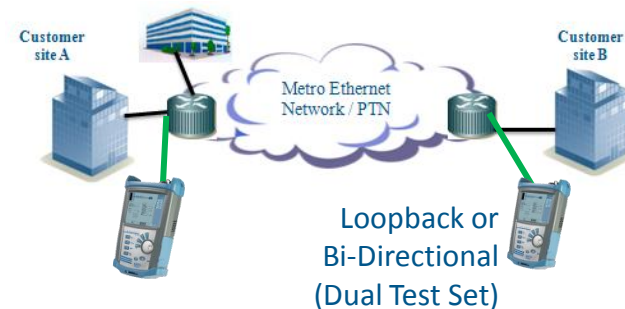


Phase 1 – Network Configuration Test

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

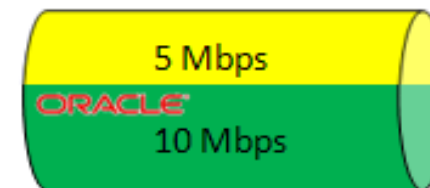
Methodology: For each service, a ramp test is used to gradually reach and exceed the CIR. All KPIs are measured against a threshold



Ramp repeated for each service

EIR
CIR

1-10 sec per step



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

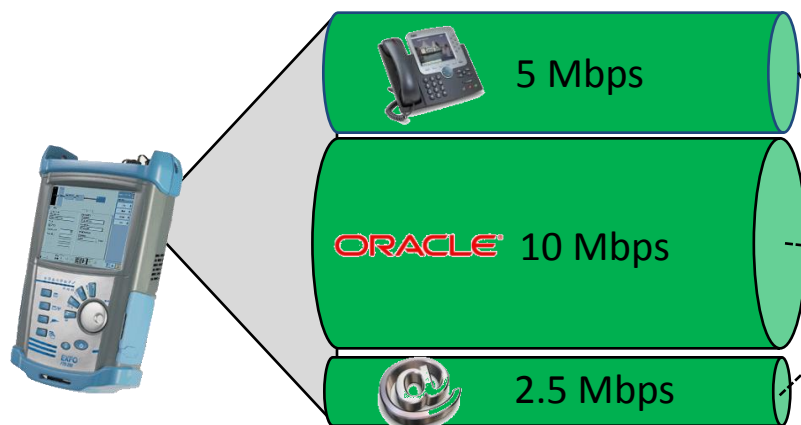
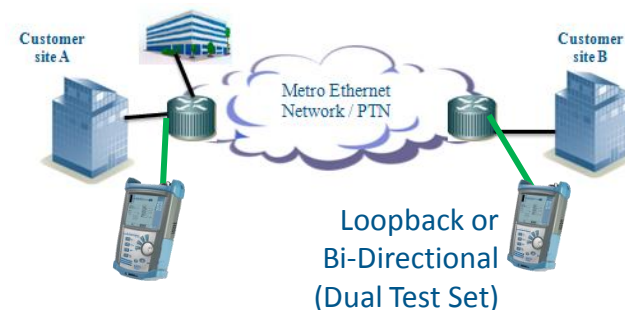
- For each service sequentially, generate a traffic ramp, first up to CIR and then up to EIR (if applicable) and then over EIR
- Verify that CIR and EIR are properly configured
- Verify all SLA parameters at each ramp step (Pass/Fail thresholds for each parameters)
- Approximate Test time: 1 minute per service

Phase 2 – Service Test

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



All SLA parameters measured throughout the test (Throughput, Latency, Frame Loss, Jitter, OOS), Pass/Fail result

- 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).

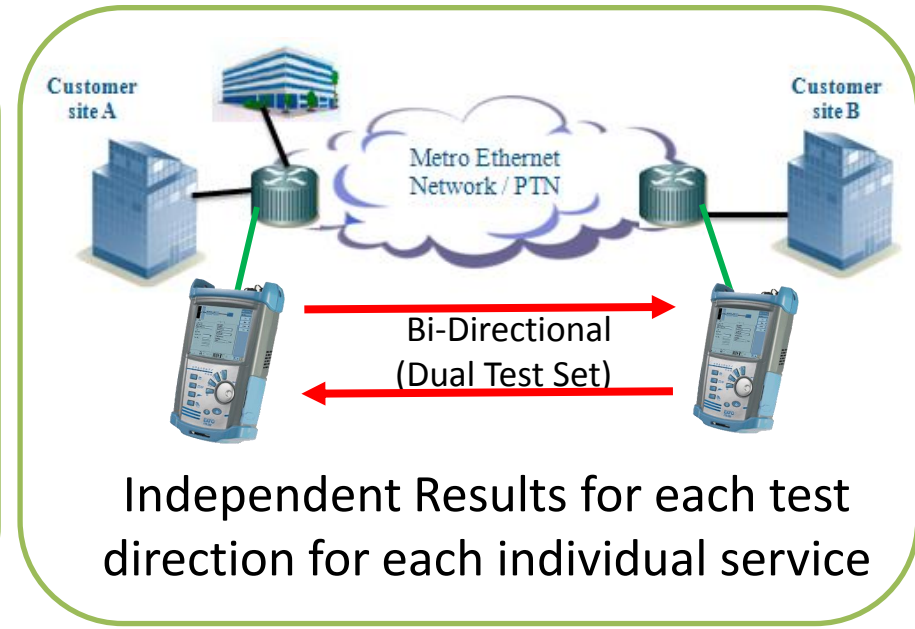
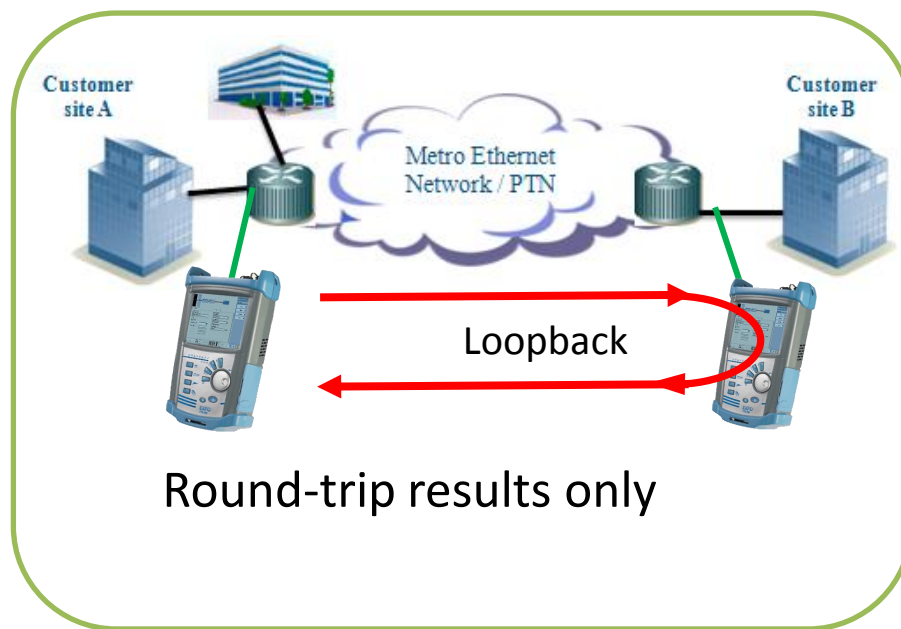
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EtherSAM: Ethernet Service Activation Methodology

- 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**

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 asymmetrical services
- Results available at both Testers

- **What is EtherSAM**
- **Issues with current methodologies and new testing trends**
- **Description of EtherSAM Methodology**
- **Advantages of EtherSAM**

EtherSAM USPs and messaging

Advantages	What's in it for the Customer
<ul style="list-style-type: none">Methodology completely adapted to today's Ethernet services:<ul style="list-style-type: none">Addressing all key SLA parameters: Throughput, Frame Loss, Latency, Jitter, Out-of-Sequence for multiple services simultaneously	<ul style="list-style-type: none">Validate complete SLA with a SINGLE TESTOptimized quality of service
<ul style="list-style-type: none">Test is much faster than RFC2544Results for several test steps on one report	<ul style="list-style-type: none">Turn-up is 8x faster than RFC2544 (based on connection with 4 classes of service)Significant OPEX reduction
<ul style="list-style-type: none">Bi-directional results for all services (based on Dual Test Set)Test can be transitioned to long term (ex. 24h)	<ul style="list-style-type: none">First time right
<ul style="list-style-type: none">Standards-based	<ul style="list-style-type: none">Feeling of confidenceCredibility 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

1

Single Test:
Complete SLA
Validation



8X Faster
Deployment

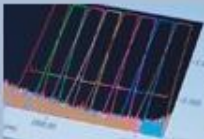


100%
First time Right



Standards based

Questions?



Design



Deployment



Service Assurance

EXFO

EXPERTISE REACHING OUT

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Thank You