



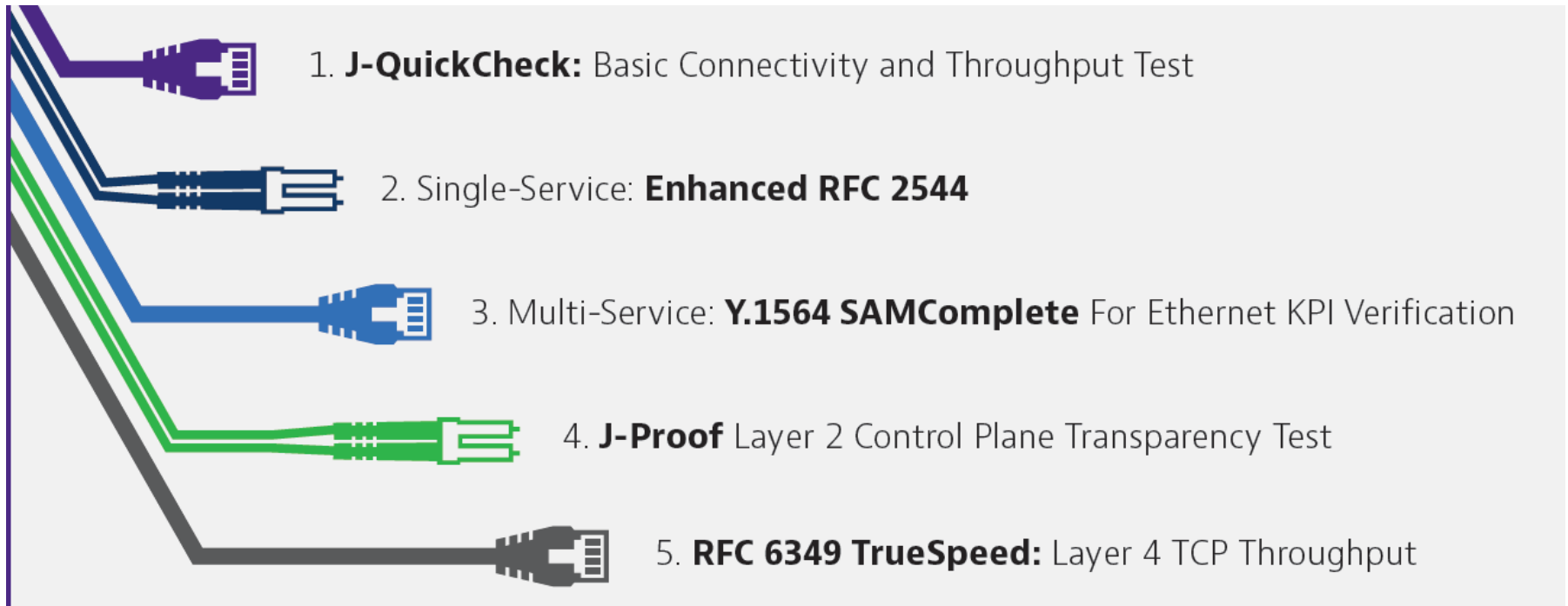
The Essentials of Ethernet Service Activation

Webinar #1

Y.1564, RFC 2544 and J-QuickCheck

Ethernet Service Activation Webinar Series

3 Webinars covering five Ethernet tests:



The Essentials of Ethernet Service Activation Series



Y.1564, RFC 2544, and QuickCheck



Layer 2 Control Plane J-Proof



RFC 6349 TrueSpeed Testing

Agenda for Today's Webinar

- Carrier Ethernet SLA's and KPI's
- Y.1564 and RFC 2544
- Where to test
- Demo of Y.1564
- QuickCheck and non-SLA services
- Demo QuickCheck
- Additional Resources and Q&A

Business Class Ethernet Services

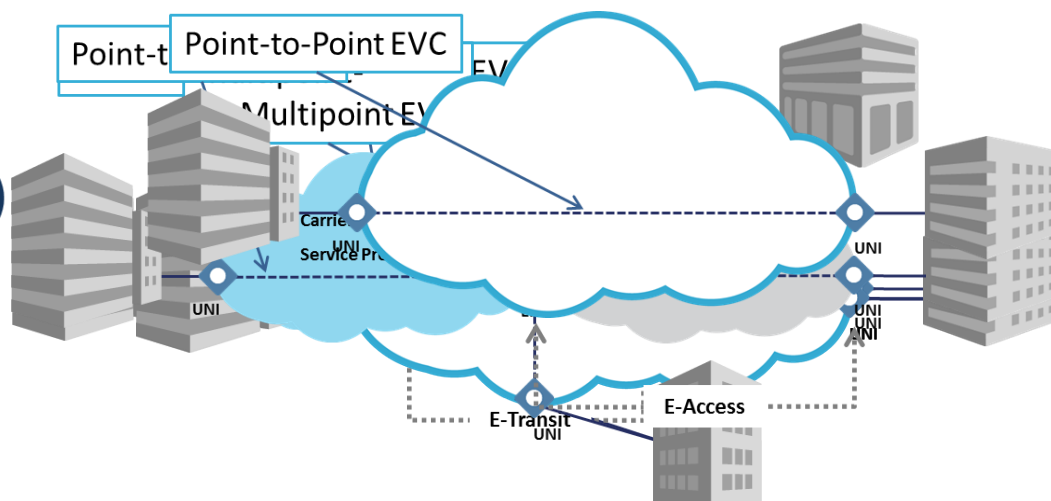
Business Class Ethernet Services What they Are

The Metro Ethernet Forum defines 5 types of carrier Ethernet services

Retail Service Types	Wholesale Service Types
E-Line	E-Access
E-LAN	E-Transit
E-Tree	

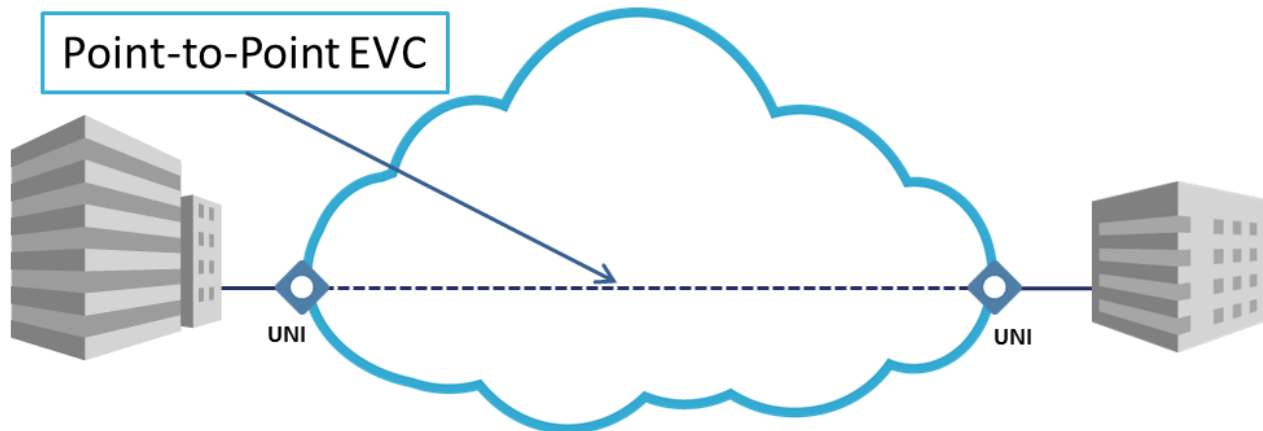
E-Access

- Multiple Endpoints (EPL)
- Transit Edge Services (EVPL)
- Transit Edge Network Access



Source: Metro Ethernet Forum

Service Level Agreements - SLAs



SLA Example

CIR (Mbps)	CBS (Kbytes)	One-Way Delay (msec)	One-Way Jitter (msec)	Frame Loss Ratio	MTTR (hours) for services	Availability
100	128	<25	<1.5	<10 ⁻⁶	<3	>99.999%

Sample SLA Values for Ethernet – MEF 23.1

Characteristics (one way)	Mobile Backhaul services	EPL/EVP	Voice Trunking Services
Bandwidth (CIR)	1 Mbps to 10 Gbps	1 Mbps to 10 Gbps	80 Kbps per call (2 Mbps per PRI)
Committed Burst Size	256 KBytes	64 KBytes	n/a
Frame Delay	< 10 ms	< 25 ms	< 40 ms
Frame Delay Variation (Jitter)	< 2 ms	< 25 ms	< 20 ms
Frame Loss	< .001 %	< .01%	< 1 %
Throughput	99.995 %	99.99 %	n/a
Availability	99.999 %	99.99 %	99.99 %
Mean-time to repair	2 hours	4 hours	4 hours

Generic Key Performance Indicators (KPIs)

Latency – Round Trip Delay

- Voice: over-talk, echo, dropped calls
- Video : choppiness and delays
- Data: long download times

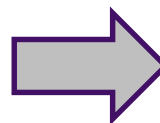
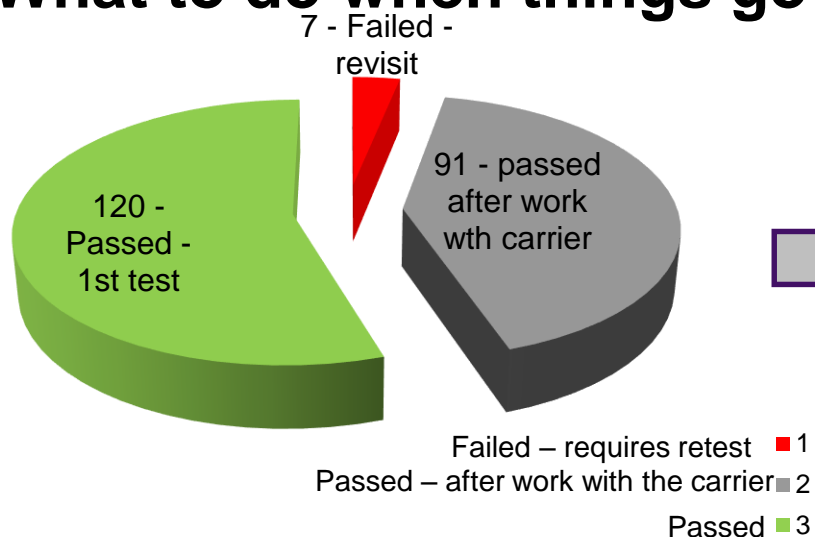
Packet Jitter – Delay Variation

- Voice: clicking and popping noises
- Video: pixelization or blue screens
- Data: minimal affect

Frame Loss

- Voice: clicks/fuzziness, dropped calls
- Video: pixelization or blue screens
- Data: long download times

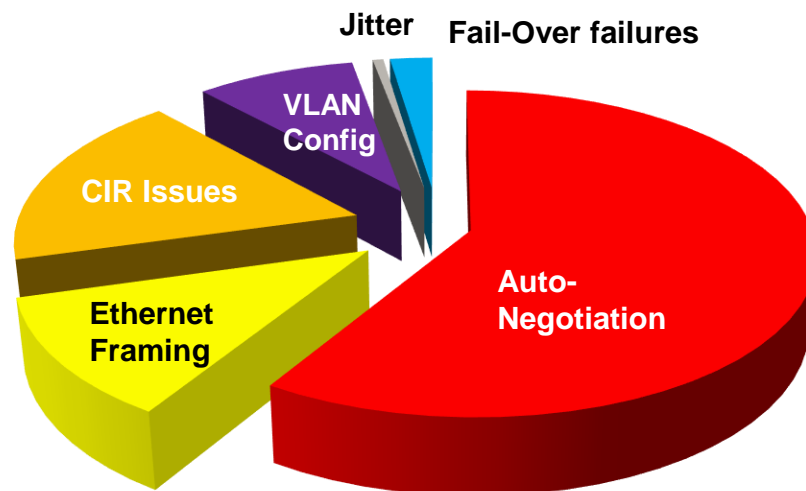
What to do when things go wrong?



45% of all tests fail the first time

Top problems:

- Auto-Negotiation set incorrectly
- 802.3 versus DIX framing
- Misconfigured CIR
- VLAN configuration problems
- Jitter
- Fail-Over Failures

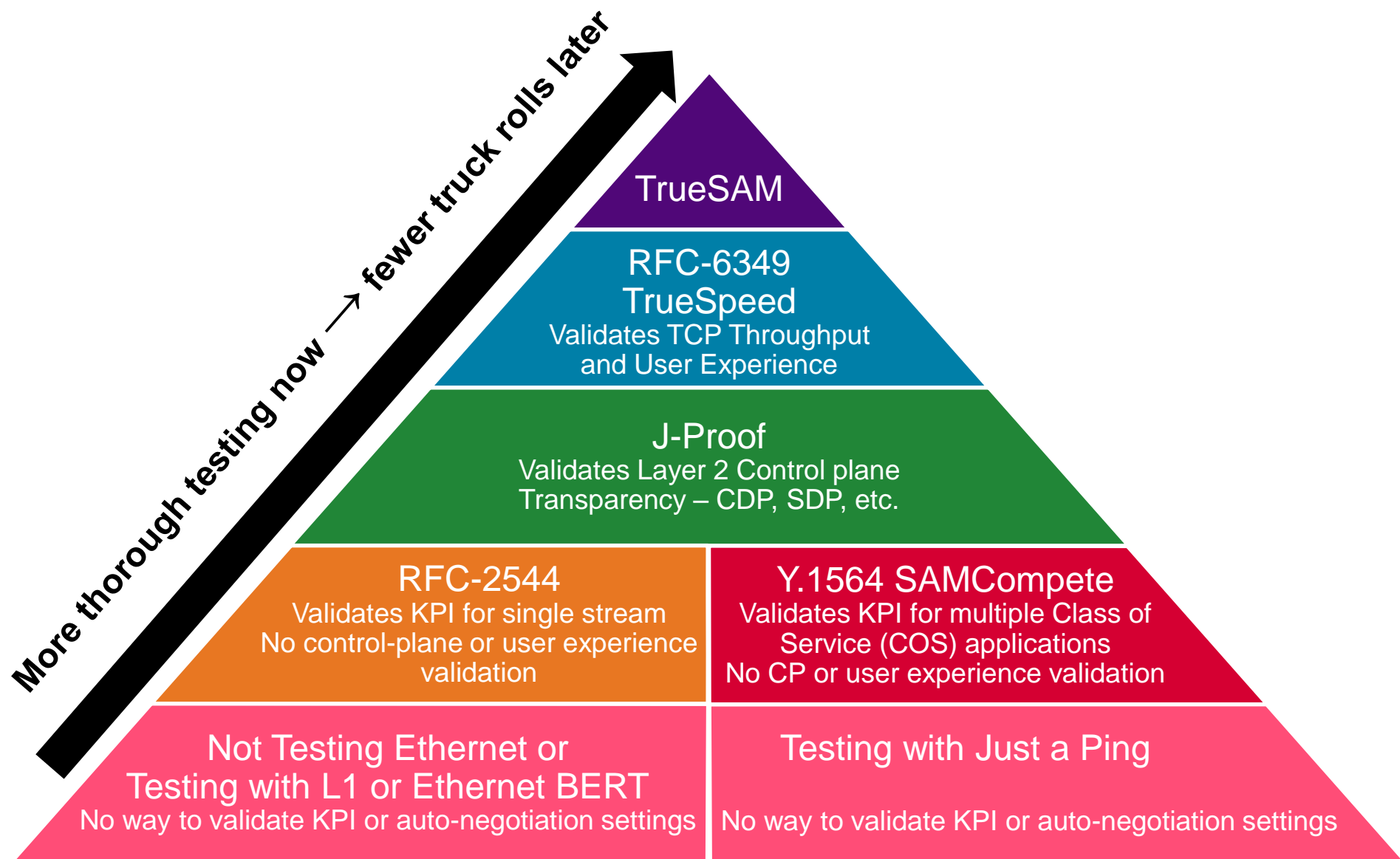


Quick Survey

What service activation test methods do you use today?

- No Testing or Testing with Ping
- RFC 2544
- Y.1564
- RFC 6349
- Layer 2 Control Plane

Reduce OpEx with Ethernet Service Activation Testing



Key Measurements and the Benefits of Service Activation Testing

Y.1564 Summary

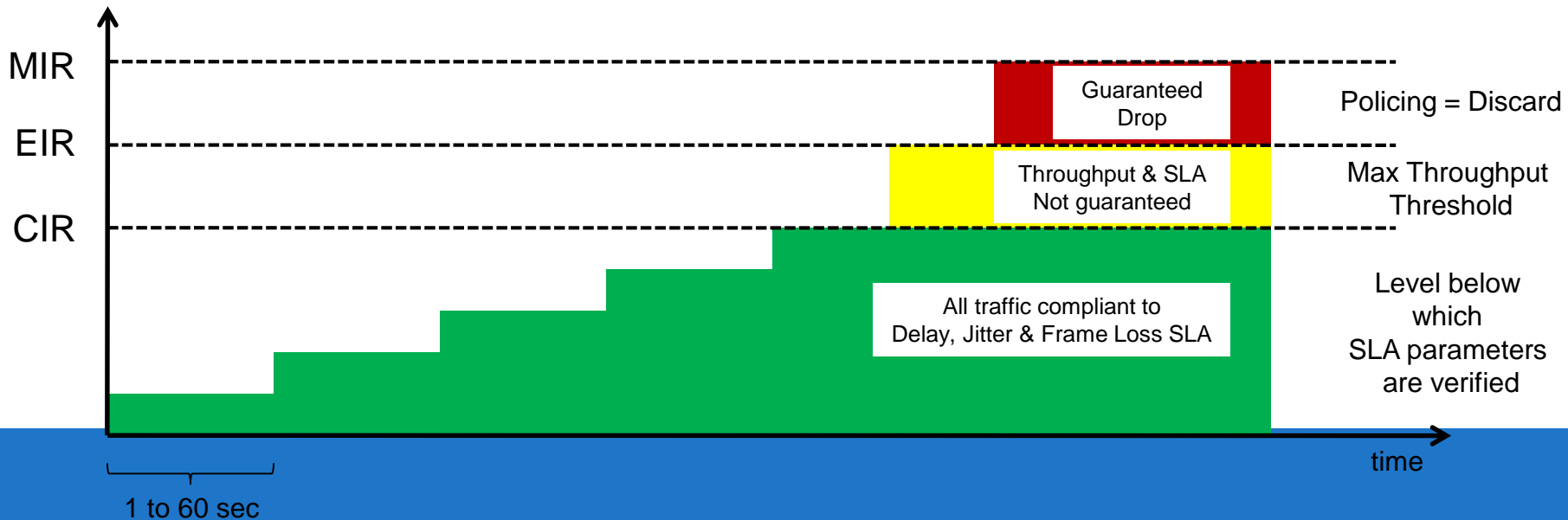
Y.1564 SAMComplete

- Newer industry standard for single and **multiple service** Ethernet and IP service activation test
- Measure Key Performance Indicators and Bandwidth Profile
 - CIR, EIR (Throughput)
 - Frame Delay – FD (Latency)
 - Frame Delay Variation – FDV (Jitter)
 - Frame Loss Rate - FLR
 - Committed Burst Size – CBS
 - Policing
- Fully automated with report generation



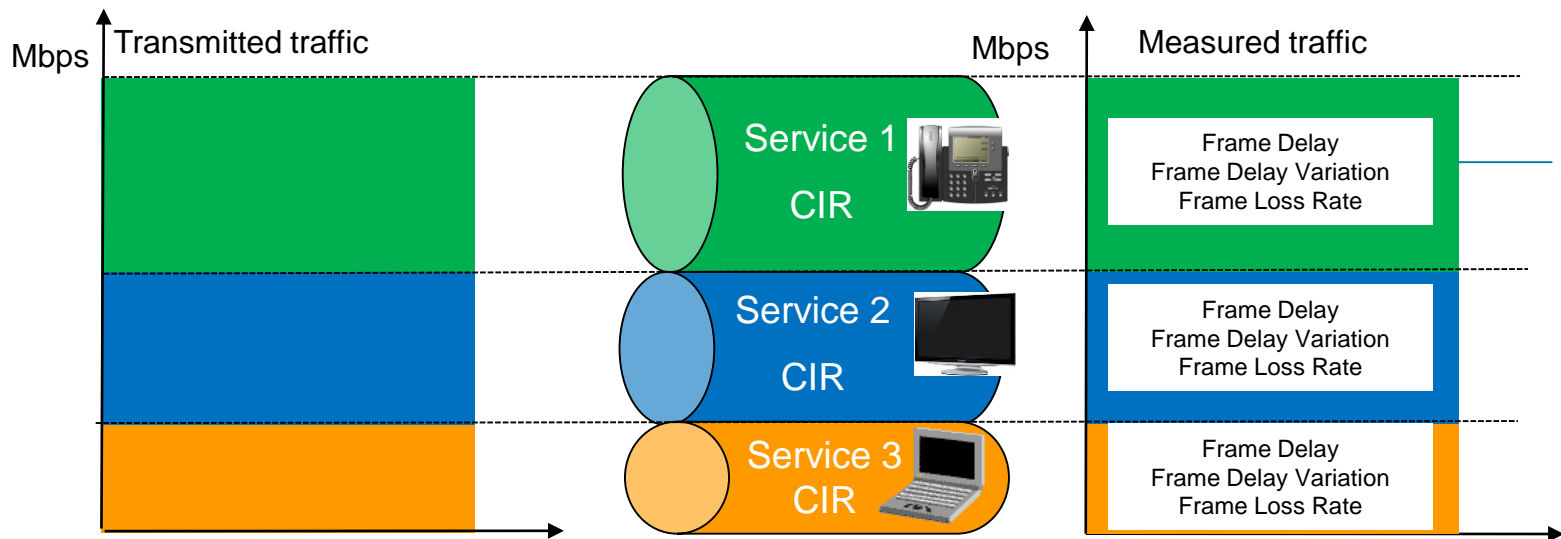
Y.1564 Part 1: Service Configuration Test (Ramp Test)

- Validates network traffic profile configuration – one service (stream) at a time
 - First stage, X steps to CIR, 1 to 60 seconds each
 - Verifies SLA parameters are met for rates lower and equal to CIR
 - SLA parameters: Throughput, Delay (FD), Jitter (FDV) and Frame Loss (FL)
 - Then step to EIR and MIR line rate
 - Verifies throughput – errors allowed in excess of CIR
 - Verifies Max Throughput does not go over the maximum allowed



Y.1564 Part 2: Service Performance Test (Multi-Service)

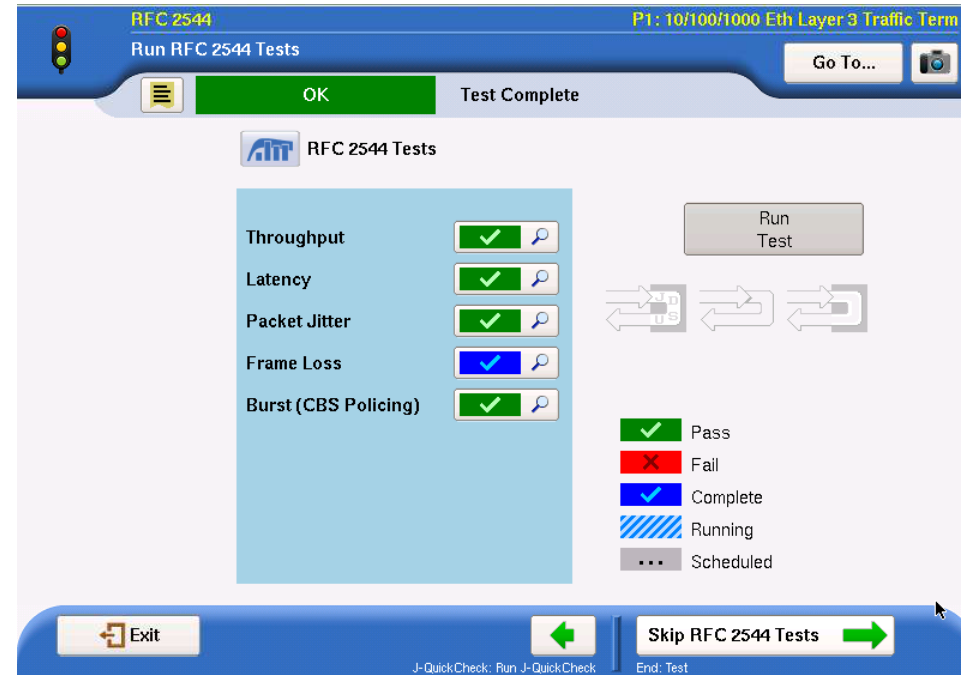
- Part 2 validates quality of service for each service and proves SLA conformance
 - All services generated **simultaneously** at their CIR and KPIs measured for each
 - This phase is a single measurement done over a mid to long-term time period
 - This procedure allows the characterization of each service and its influence on others and ensures that they all comply to their respective SLA



RFC 2544 Summary

Enhanced RFC 2544

- Widely used service activation test for Ethernet and IP services
- **Single service** test
- Measure Key Performance Indicators and Bandwidth Profile
 - Throughput
 - Latency
 - Frame Loss
 - Packet Jitter
 - Committed Burst Size - CBS
- Fully automated with report generation



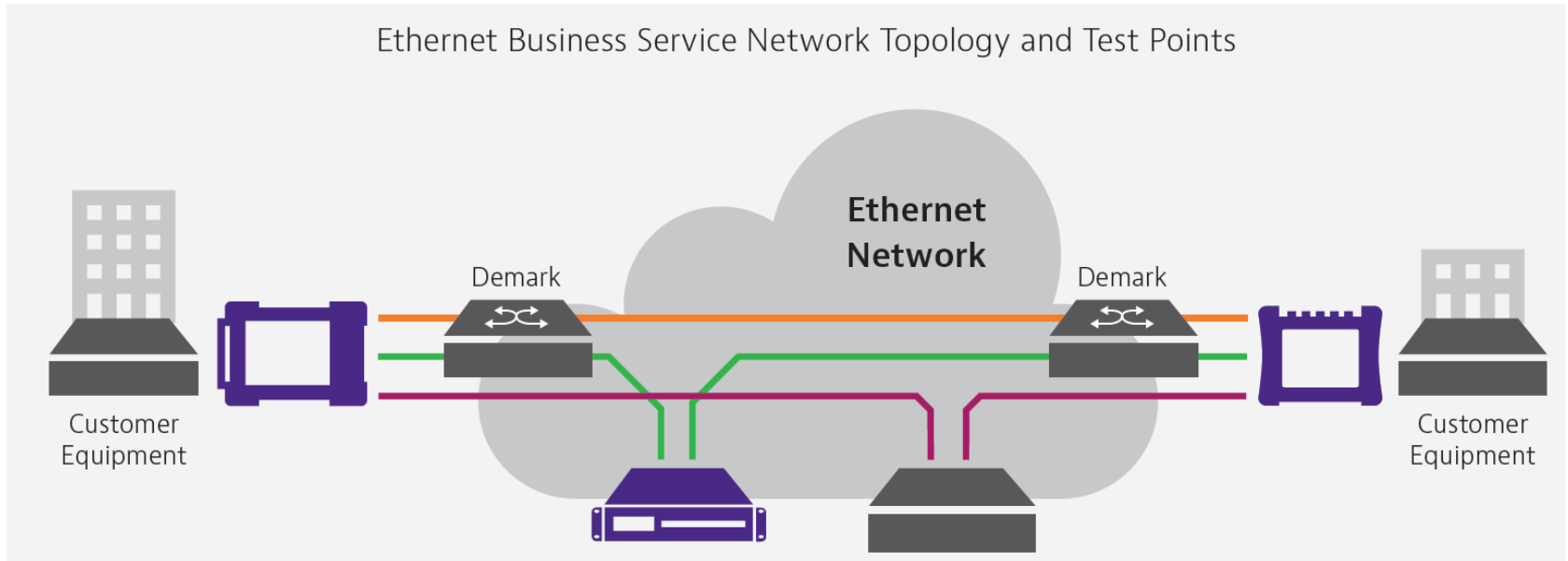
Comparison of Measurements in RFC 2544 vs. Y.1564

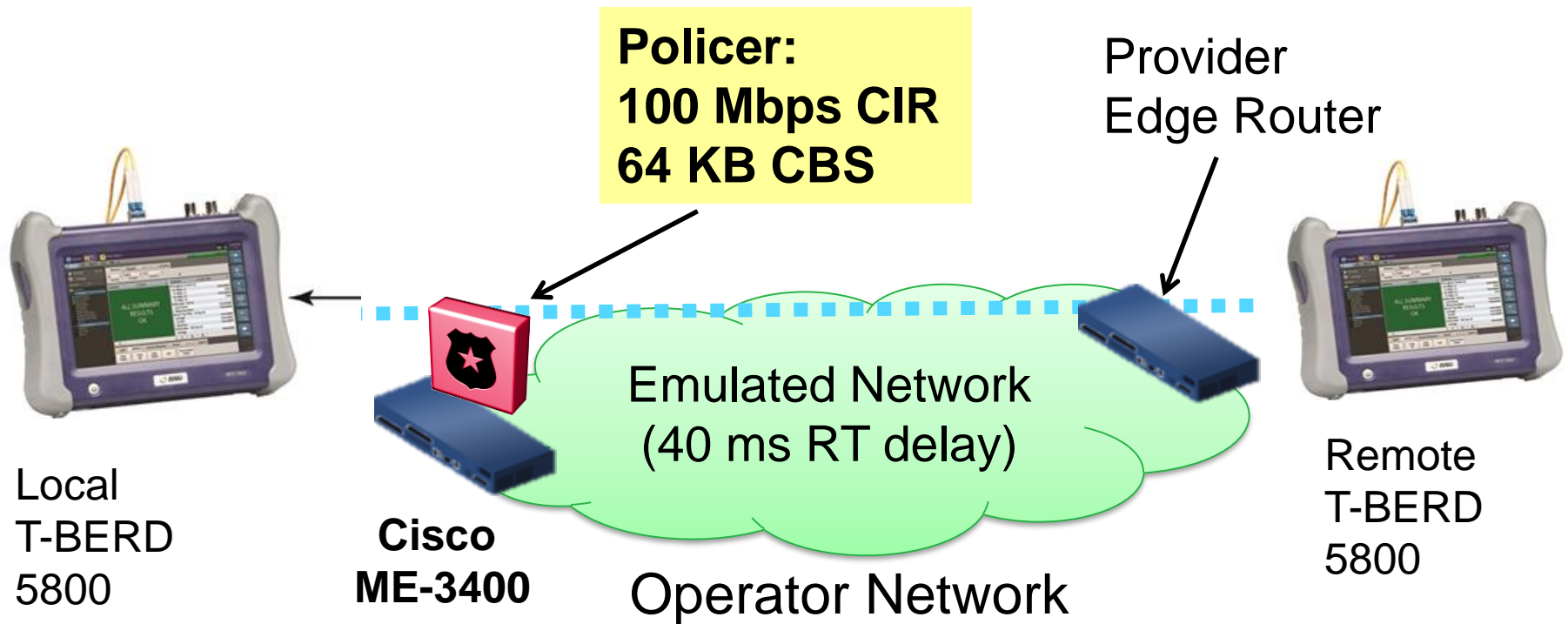
RFC 2544	Y.1564	Measurement
Throughput	Committed Information Rate (CIR)	The speed in Mbps of traffic that can be transmitted
Latency	Frame Delay (FD)	The time in ms or μ s it takes traffic to be transmitted
Frame Loss	Frame Loss Ratio (FLR)	The rate that frames are lost as they are transmitted
Jitter*	Frame Delay Variation (FDV)	The difference in latency from one packet to the next
Burst*	Committed Burst Size (CBS)	The number of bytes that can be transmitted at line rate without losing packets
N/A	Policing	Tests that policers are configured properly so that customers cannot get more than they paid for

*added to Viavi Enhanced RFC 2544

Testing Scenarios and Demos

Logical Ethernet Business Service Topology





Network is Gigabit end-end, but policed to 100 Mbps in the direction of the Local to Remote TBERD

Non-SLA services

- Sometimes techs need to test Ethernet services and circuits without an SLA
- Examples:
 - Internal network connections such as transport circuits
 - Installation of network equipment or replacement of line cards
 - Low cost “Best Efforts” internet access services
- A simpler test is often the right solution

QuickCheck

- Pre-test in RFC 2544 or Y.1564
- Standalone test for non-sla services
- Checks
 - Near-end connectivity and auto negotiation
 - Connectivity to far end and loopback detection
- Measures
 - Throughput
 - Frame loss

The screenshot displays the QuickCheck software interface. At the top, the title bar reads "QuickCheck" and "P1: 100GigE Layer 2 QuickCheck". Below the title bar, a blue banner indicates the test status as "COMPLETE" and "Test Complete".

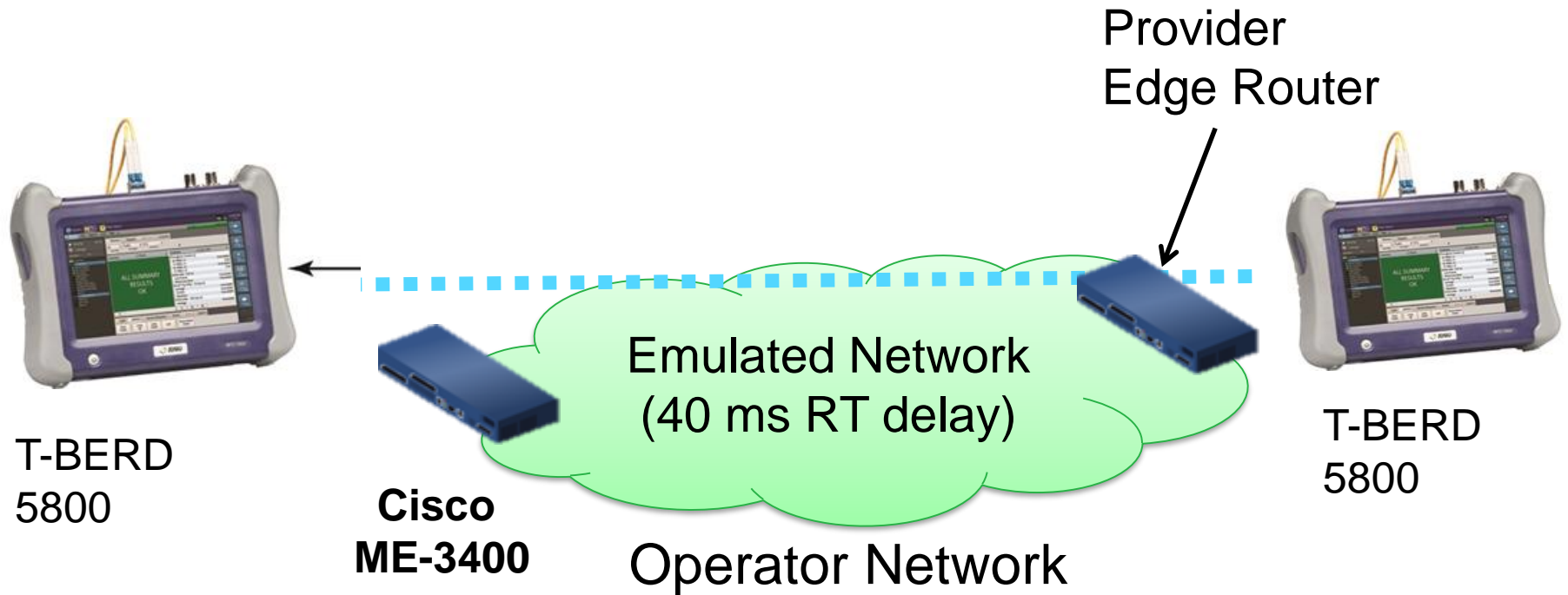
The main area features a network diagram showing a local device connected to a "Local" port, which is connected to a cloud representing the network, and then to a "Remote" port. The remote port is labeled "Active" and shows a green double-headed arrow. To the right of the diagram are several icons representing different test configurations.

Below the diagram, the test results are displayed:

- Throughput: 100000 Mbps (L1), Duration: 180 Seconds, Frame Size: 512 Bytes
- Local Port: UP (100000 / FD)
- Auto Negotiation: N/A
- Remote Loop: Active Loop
- Measured Throughput (L1 Mbps): 99996

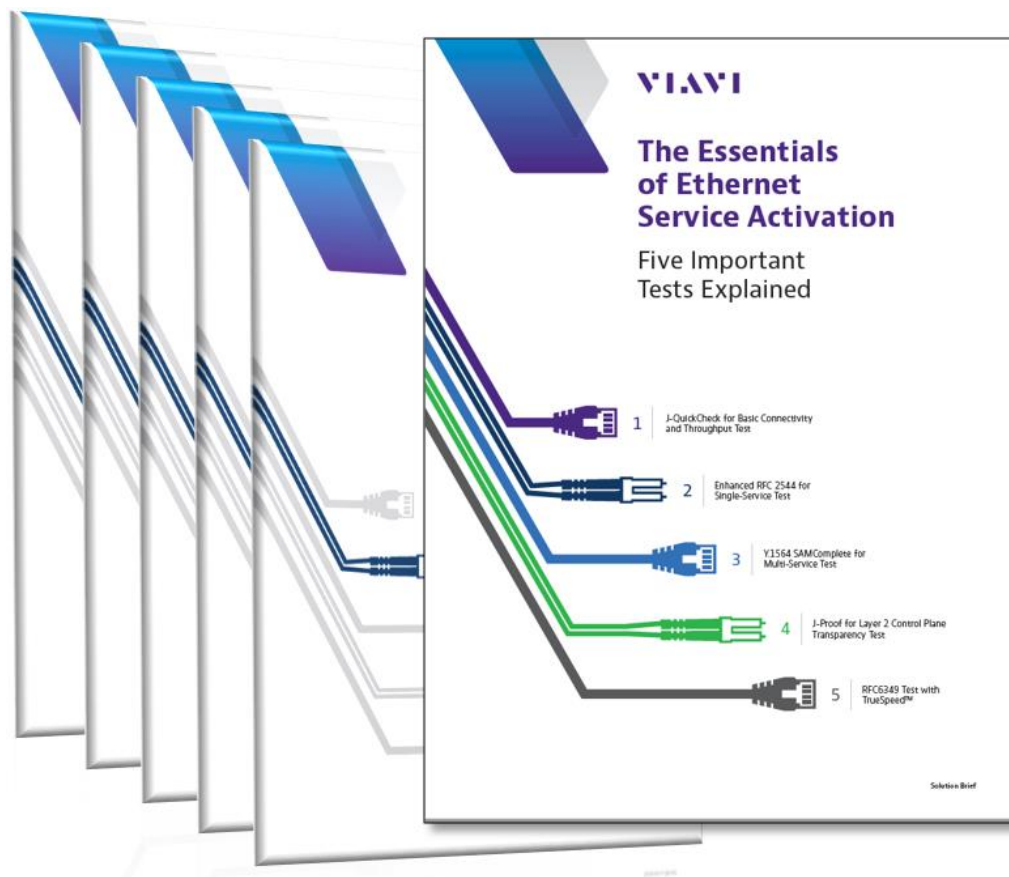
At the bottom of the interface, there are buttons for "Exit" and "Next", along with a "Start" button and a "Report Info" link.

QuickCheck Demo



Network is Gigabit end-end, with no policing

Wrap-up and Q&A



Stay tuned for a follow-up email with links to a whitepaper series with more details on the topics covered today

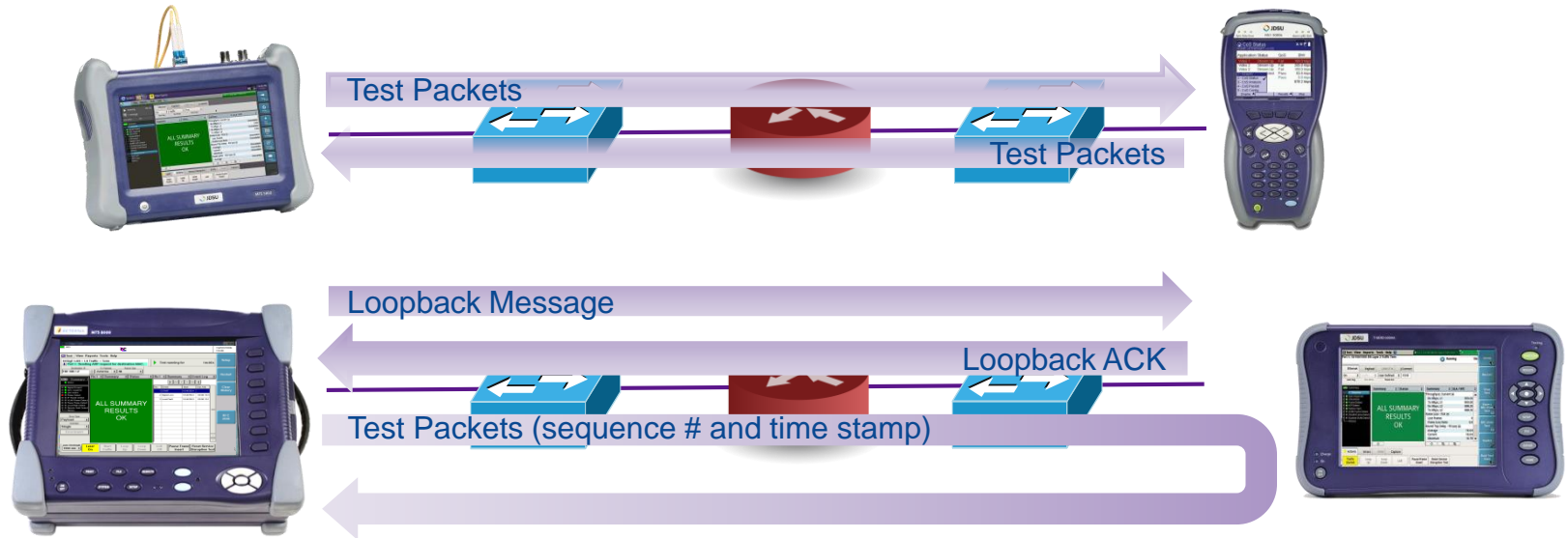
Presenter Contact Information

Michael Bangert: michael.bangert@viavisolutions.com

Barry Constantine: barry.constantine@viavisolutions.com

Head to Head versus Loopback Testing

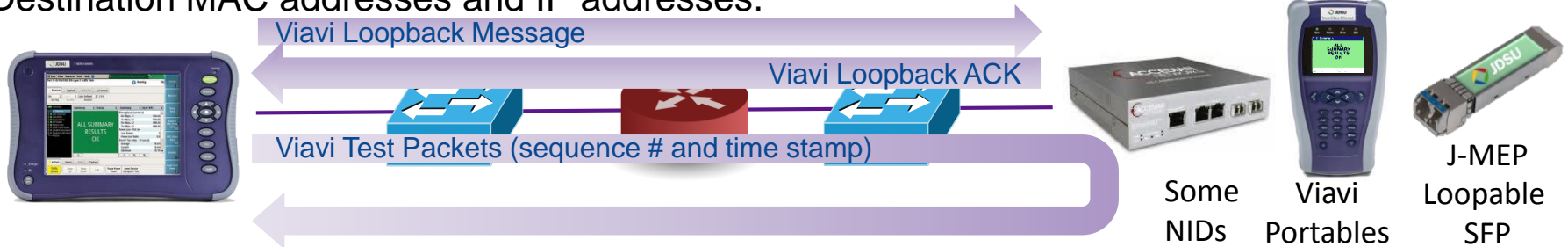
- Traffic can either be generated **Head to Head** between two test sets or to a **Loopback Device**.



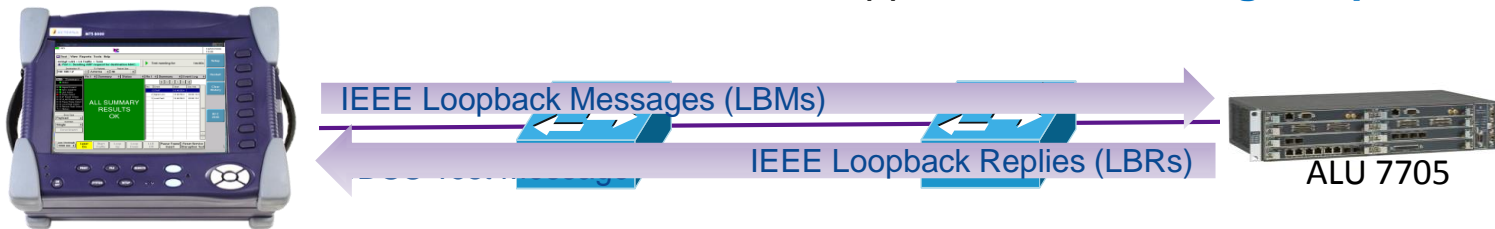
- Testing to a **Loopback Device** offers the following advantages:
 - Less experienced technician can set up the loopback device.
 - Round Trip Delay measurement.
 - Faster initiation of automated tests (QuickCheck, Enhanced RFC-2544, etc.)
 - Single report containing bidirectional test results.

Loopback Devices

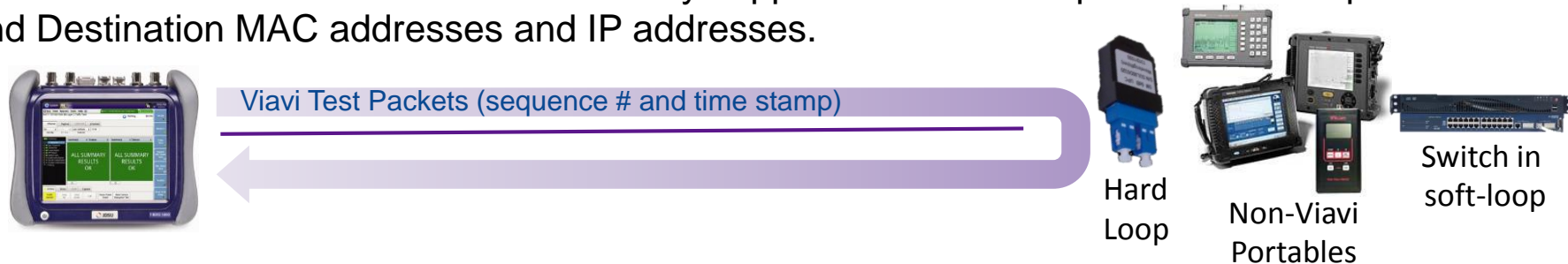
- Viavi Test equipment and some NIDs support Viavi proprietary loopbacks that swap Source and Destination MAC addresses and IP addresses.



- Some Carrier Ethernet switches and NIDs support **IEEE 802.11ag Loopback Messages**.



- Other switches and non-Viavi Test Sets may support “software” loopbacks that swap Source and Destination MAC addresses and IP addresses.



* **Hard loops generally cannot be used across Switches and Routers, but may be used across a “Layer 1” circuit, such as fiber link.**

Viavi Recommended Best Practice Workflows

J-QuickCheck
Basic
Connectivity and
Throughput Test

Single Service:
Enhanced RFC 2544
Multi-Service
Y.1564
SAMComplete

For Ethernet KPI Verification

J-Proof
Layer 2 Control
Plane
Transparency
Test:

RFC 6349
TrueSpeed
Layer 4 TCP
Throughput

Best Practice Workflow (Single and Multiple Services)

J-QuickCheck
Basic
Connectivity Test














Y.1564
SAMComplete
Ethernet KPI
Verification for
Multiple Services

J-Proof
Layer 2 Control
Plane
Transparency
Test:

RFC 6349
TrueSpeed
Layer 4 TCP
Throughput

Multiple Class of Service (COS) Workflow

Summary of the Various Standards Based Tests and Problem Solved

Turn-up Related Problem	RFC2544	Y.1564	RFC 6349
Single Service, Layer 2/3 SLA Issues (loss, jitter, etc.).			N/A
Multi-service, Layer 2/3 SLA Issues (service prioritization, loss, jitter, etc.).			N/A
Demonstrate the effect of End customer TCP Window size on throughput (CPE issue).			
Inadequate device buffers to handle bursty applications.			
Policing effects to TCP performance.			



VI.VI

JDSU RFC 2544 Test Parameters

- Configurable test times
 - 5 min – 6 hours
- Configurable frame sizes
 - Including Jumbo
- Packet Jitter included
 - Real-time services – voice and video
- Maximum Bandwidth
 - Committed throughput guaranteeing Key Performance Indicators (KPIs)
- Concurrent tests reduce test time by half
 - Measure Throughput, Delay, and Jitter simultaneously

Pass / Fail	Frame Length (Bytes)	Cfg Rate (Mbps)	Measured L1 Rate (Mbps)	Measured L2 Rate (Mbps)	Measured L3 Rate (Mbps)	Measured L4 Rate (Mbps)	Measured L1 % of Line Rate	Measured Rate (Frams/sec)	Pause Det
PASS	64	100,00	100,00	76,19	54,76	30,95	10,000	148810	No
PASS	512	100,00	100,00	96,24	92,86	89,10	10,000	23497	No
PASS	1518	100,00	100,01	98,71	97,54	96,24	10,001	8128	No

J-QuickCheck

The Problems

- It takes too long to get the test set-up correctly before actually starting
- Users mis-configure the test set auto-negotiation and loopback settings
- It's a waste of time to run the full test if throughput is way off from expected

The Solution

- Saves valuable time by performing quick end-to-end connectivity and configuration test
- Verifies test set auto-negotiation settings and connectivity to far end with proper loopback
- Quickly verifies end-to-end throughput

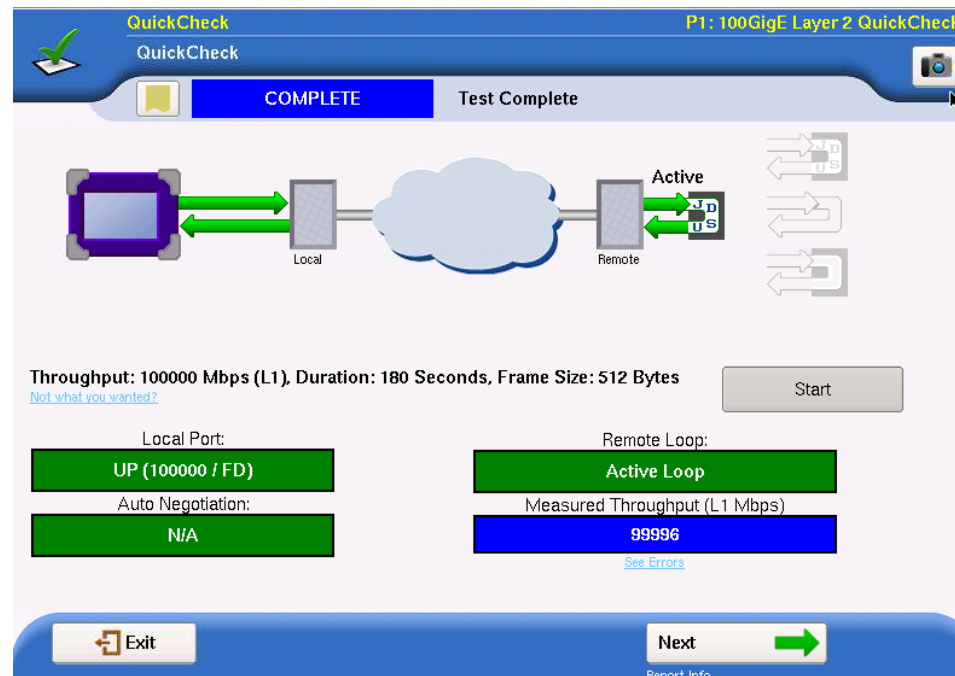
The screenshot displays the J-QuickCheck software interface. At the top, there are tabs for 'P1: 1 GigE Layer 2 Traffic Term', 'P2: 1 GigE', and 'Results'. Below the tabs, there are navigation buttons: 'J-QuickCheck', 'Configs', 'Symmetry', 'J-Connect', and 'Setup'. The main area features a network diagram with a server icon on the left, a cloud in the middle, and a switch icon on the right. Green double-headed arrows indicate connectivity between the server and the switch, and between the switch and the cloud. To the right of the diagram, there are two status indicators: 'Hardware' and 'Permanent', both with green double-headed arrows. Below the diagram, there are three configuration panels: 'Local Port: (Up or Down)' with a green 'UP (1000 / FD)' button; 'Auto Negotiation: (ON or OFF)' with a green 'ON' button; and 'Remote Loop: (Hardware, Permanent or Active)' with a green 'Active Loop' button. To the right of these panels is a 'Basic Load Test' section with a green 'Complete' button, 'Frame Size: 1518 (bytes)', 'Expected Throughput', and '10.000% = 100.00 Mbps'. At the bottom center, there is a green 'Run RFC 2544 Test' button. At the bottom left, there is an 'Exit' button, and at the bottom right, there is an 'Exit J-QuickCheck' button.

J-QuickCheck

Save test time if a major configuration problem exists



- Save time by automating the first few steps of the M&P
- Available as a standalone test or...
- Integrated into both RFC 2544 and Y.1564 tests
- One screen test setup determines:
 - Correct auto-negotiation settings
 - Connectivity and loopback with the far end and
 - Performs a quick throughput test



Feature	Description	Benefit
Identifies auto-negotiation settings	Automatically configures auto-negotiation settings to match local network	User error of auto-negotiation settings is eliminated
Verifies connectivity to the far end	Only need to configure far end IP address to connect	Users don't need to know all the low level details of setup and configuration
Quick throughput test	Rapid throughput test to ensure that circuit is active	Saves valuable test time if some major configuration problem exists in the network or with the test sets

VI.VI

