The Essentials of Ethernet Service Activation Series

Webinar #2
J-Proof: Layer 2 Control Plane Transparency Test
Ethernet Service Activation Webinar Series

3 Webinars covering five Ethernet tests:

1. **J-QuickCheck**: Basic Connectivity and Throughput Test

2. **Single-Service**: Enhanced RFC 2544

3. **Multi-Service**: Y.1564 SAMComplete For Ethernet KPI Verification

4. **J-Proof** Layer 2 Control Plane Transparency Test

5. **RFC 6349 TrueSpeed**: Layer 4 TCP Throughput
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>JUNE 14</td>
<td>Y.1564, RFC 2544, and QuickCheck</td>
</tr>
<tr>
<td>JUNE 28</td>
<td>Layer 2 Control Plane J-Proof</td>
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<tr>
<td>JULY 12</td>
<td>RFC 6349 TrueSpeed Testing</td>
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Agenda for Today’s Webinar

- Carrier Ethernet Services and Layer 2 Control Plane
- Layer 2 Control Plane Protocols
- Where to test
- Demos of J-Proof
- 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.

<table>
<thead>
<tr>
<th>Retail Service Types</th>
<th>Wholesale Service Types</th>
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<tbody>
<tr>
<td>E-Line</td>
<td>E-Access</td>
</tr>
<tr>
<td>E-LAN</td>
<td>E-Transit</td>
</tr>
<tr>
<td>E-Tree</td>
<td></td>
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### E-Types:

- Multilink ATM Service (ML-ATM)
- E-Tree Provider-Provided Bridge service (EVP-BR)
- E-Tree Provider-Provided VLAN service (EVP-VLAN)
- E-Tree Provider-Provided Layer 2 service (EVP-L2)
- E-Tree Provider-Provided Layer 3 service (EVP-L3)

**Source:** Metro Ethernet Forum
Layer 2 Control Plane Transparency

- RFC2544, Y.1564 and RFC6349 validate Data Plane performance of Ethernet networks
- Network must be transparent to Control Plane traffic to ensure seamless operation of deployed services
- Control Plane transparency problems are extremely hard to identify and troubleshoot
Three Choices for L2 Control Plane Frames

- UNI or ENNI
- Peer
- Discard
- Pass

Source: MEF 45 Multi-CEN L2CP
Decision Points for L2 Control Plane Frames

**E-Line**
- Virtual Private Lines (EPL)
- Ethernet Private Lines (EVPL)
- Ethernet Internet Access

**E-Transit**
- Wholesale Transit Services
- Transit E-Line
- Transit E-LAN
Viavi J-Proof – Layer 2 Control Plane Transparency Test

A CDP frame is dropped by switch!

- J-Proof is a unique Viavi Pass/Fail test that validates Ethernet circuit Layer 2 Control Plane transparency
- J-Proof simulates traffic of common Control Plane protocols and passes it thru the network end to end
- J-Proof will identify wide range of Control Plane transparency issues and save considerable troubleshooting time and effort
Viavi J-Proof – Layer 2 Control Plane Transparency Test

- J-Proof test is extremely easy to configure and can be run in minutes on any Viavi TBERD test set
- J-Proof is a software option available standalone or as part of Viavi Ethernet Troubleshooting Bundle
Quick Survey

- Have you had problems with Layer 2 Control plane transparency in your network?
  - More than 10 times
  - More than 5 times
  - Once or twice
  - Never
Reduce OpEx with Ethernet Service Activation Testing

- **TrueSAM**
- **RFC-6349**
  - TrueSpeed
  - Validates TCP Throughput and User Experience
- **J-Proof**
  - Validates Layer 2 Control plane Transparency – CDP, SDP, etc.
- **RFC-2544**
  - Validates KPI for single stream
  - No control-plane or user experience validation
- **Y.1564 SAMCompete**
  - Validates KPI for multiple Class of Service (COS) applications
  - No CP or user experience validation
- **Not Testing Ethernet or Testing with L1 or Ethernet BERT**
  - No way to validate KPI or auto-negotiation settings
- **Testing with Just a Ping**
  - No way to validate KPI or auto-negotiation settings

More thorough testing now → fewer truck rolls later
Ethernet Layer 2
Control Plane
Protocol
Summary
Ethernet Control Plane Functions

- Ethernet control plane protocols generally can be categorized into the following groups:
  - Spanning Tree Protocols (STP, RSTP, etc.)
  - Cisco Protocols (CDP, VTP, etc.)
  - IEEE Protocols (LACP, GMRP, etc.)

- These protocols vary in function but all enable a Layer 2 network to intelligently communicate with peer devices to enable proper Layer 2 switching

- The next slides will highlight one from each category
Spanning Tree Protocols: STP

- The **Spanning Tree Protocol (STP)** builds a logical loop-free topology for Ethernet networks, preventing bridge loops and the broadcast “storms” that results from them.
- Spanning tree also allows a network design to include spare (redundant) links to provide automatic backup paths if an active link fails.
- STP disables those links that are not part of the spanning tree, leaving a single active path between any two network nodes.

**STP “Learning” States**

**Final STP State**
Cisco Protocols: CDP

- **Cisco Discovery Protocol (CDP)** is a proprietary Data Link Layer protocol developed by Cisco Systems. It is used to share information about other directly connected Cisco equipment, such as the operating system version and IP address.

- CDP can be used by network management systems and engineers to trace paths throughout a network.

- In 2006, IEEE 802.1AB Link Layer Discovery Protocol (LLDP) was introduced and is implemented by multiple vendors and is functionally similar to CDP.
IEEE Protocols: LACP

- The **Link Aggregation Control Protocol (LACP)** provides a method to control the bundling of several physical ports together to form a single logical channel.

- LACP allows a network device to negotiate an automatic bundling of links by sending LACP packets to the peer (directly connected device that also implements LACP).

![Diagram of LACP network setup]
## Technical Summary of Popular Layer 2 Control Plane Protocols (1)

<table>
<thead>
<tr>
<th>Control Protocol: Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GARP Multicast Registration Protocol (GMRP)</strong> is a Generic Attribute Registration Protocol (GARP) application that provides a constrained multicast flooding facility similar to IGMP snooping.</td>
</tr>
<tr>
<td><strong>Multiple VLAN Registration Protocol (MVRP)</strong> was introduced in order to replace a serious flaw in GARP and GMARP, where a simple registration or a failover could take an extremely long time to converge on a large network,[2] incurring a significant bandwidth degradation.</td>
</tr>
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<td><strong>Link Aggregation Control Protocol (LACP)</strong> provides a method to control the bundling of several physical ports together to form a single logical channel. LACP allows a network device to negotiate an automatic bundling of links by sending LACP packets to the peer (directly connected device that also implements LACP).</td>
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<tr>
<td><strong>Cisco Discovery Protocol (CDP)</strong> is a proprietary protocol developed by Cisco Systems. It is used to share information about other directly connected Cisco equipment, such as the operating system version and IP address.</td>
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<tr>
<td><strong>VLAN Trunking Protocol (VTP)</strong> is a Cisco proprietary protocol that propagates the definition of Virtual Local Area Networks (VLAN) on the local area network.</td>
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### Technical Summary of Popular Layer 2 Control Plane Protocols (2)

#### Control Protocol: Brief Description

<table>
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<td><strong>Port Aggregation Protocol (PAgP)</strong></td>
<td>is a Cisco Systems proprietary networking protocol, which is used for the automated, logical aggregation of Ethernet switch ports, known as an ether channel. The PAgP is proprietary to Cisco Systems. A similar protocol known as LACP.</td>
</tr>
<tr>
<td><strong>Dynamic Trunking Protocol (DTP)</strong></td>
<td>is a proprietary networking protocol developed by Cisco Systems for the purpose of negotiating trunking on a link between two VLAN-aware switches, and for negotiating the type of trunking encapsulation to be used.</td>
</tr>
<tr>
<td><strong>Spanning Tree Protocol (STP)</strong></td>
<td>is a network protocol that builds a logical loop-free topology for Ethernet networks. The basic function of STP is to prevent bridge loops and the broadcast radiation that results from them.</td>
</tr>
<tr>
<td><strong>Rapid Spanning Tree Protocol (RSTP)</strong></td>
<td>In 2001, the IEEE introduced Rapid Spanning Tree Protocol (RSTP) as 802.1w. RSTP provides significantly faster spanning tree convergence after a topology change, introducing new convergence behaviors and bridge port roles to do this. RSTP was designed to be backwards-compatible with standard STP.</td>
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</table>
Testing Scenarios and Demos
Logical Ethernet Business Service Topology
Network is Gigabit end-end with Cisco ME-3400 switch and default settings
J-Proof Layer 2 Transparency Demo #2

Emulated Network (40 ms RT delay)

Provider Edge Router

Operator Network

Network is Gigabit end-end with Cisco ME-3400 switch reconfigured to pass Layer 2 protocols transparently
Viavi Recommended Best Practice Workflows

**Multiple Class of Service (COS) Workflow**
- **J-QuickCheck**
  - Basic Connectivity and Throughput 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

**Best Practice Workflow (Single and Multiple Services)**
- **J-QuickCheck**
  - Basic Connectivity and Throughput Test
- **Single Service:**
  - Enhanced RFC 2544 Multi-Service Y.1564 SAMComplete
- **J-Proof**
  - Layer 2 Control Plane Transparency Test:
- **RFC 6349**
  - TrueSpeed Layer 4 TCP Throughput
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.

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