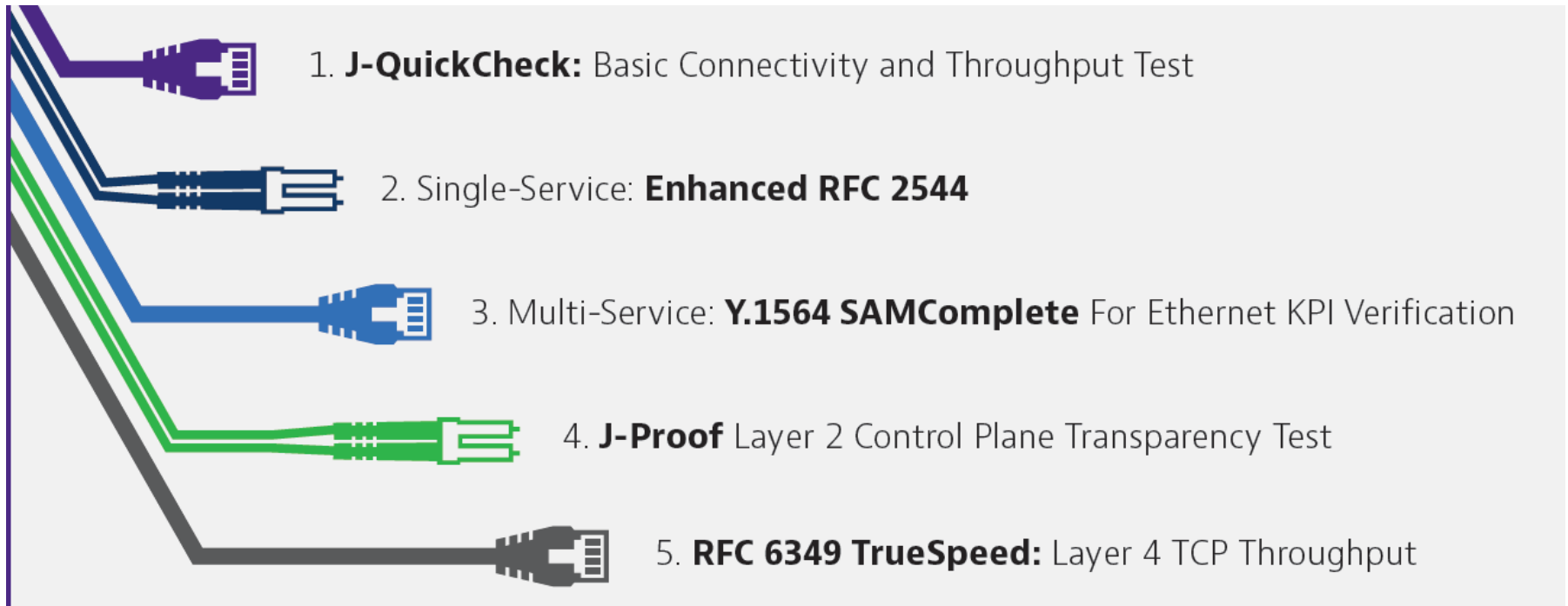# The Essentials of Ethernet Service Activation Series

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

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The Essentials of Ethernet Service Activation Series

JUNE
14
2:00 PM EST

Y.1564, RFC 2544, and QuickCheck

JUNE
28
2:00 PM EST

Layer 2 Control Plane J-Proof

JULY
12
2:00 PM EST

RFC 6349 TrueSpeed Testing

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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

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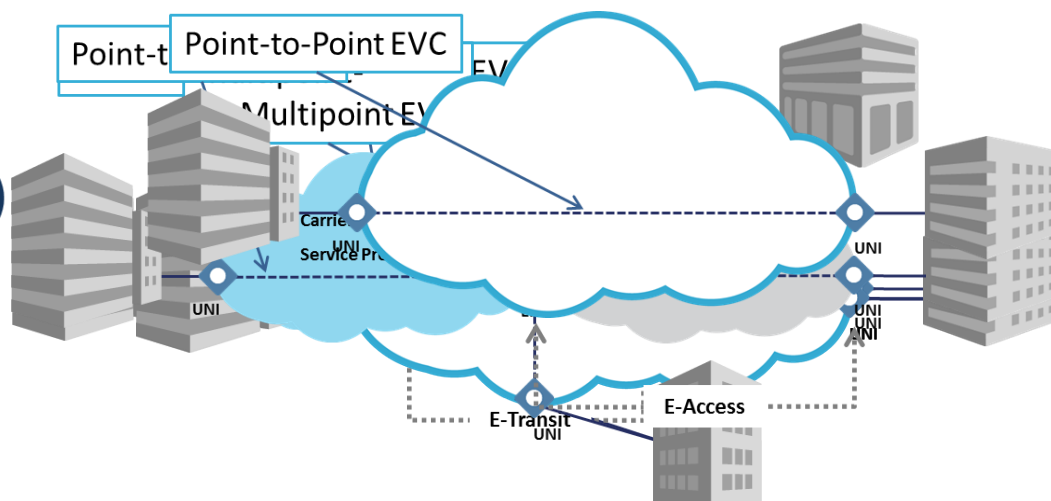
Business Class Ethernet Services

Business Class Ethernet Services What they Are

The Metro Ethernet Forum defines 5 types of carrier Ethernet services

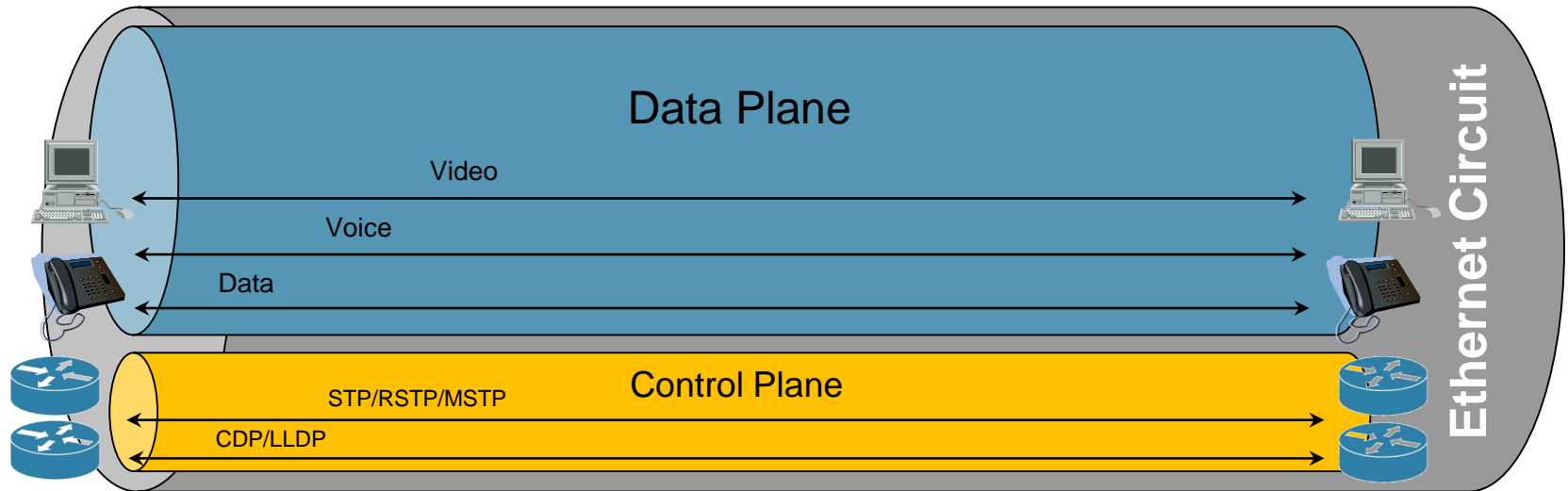| Retail Service Types	Wholesale Service Types
E-Line	E-Access
E-LAN	E-Transit
E-Tree	

Source: Metro Ethernet Forum

Layer 2 Control Plane Transparency

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

Three Choices for L2 Control Plane Frames

Peer

L2CP → UNI or ENNI → Pass

Discard
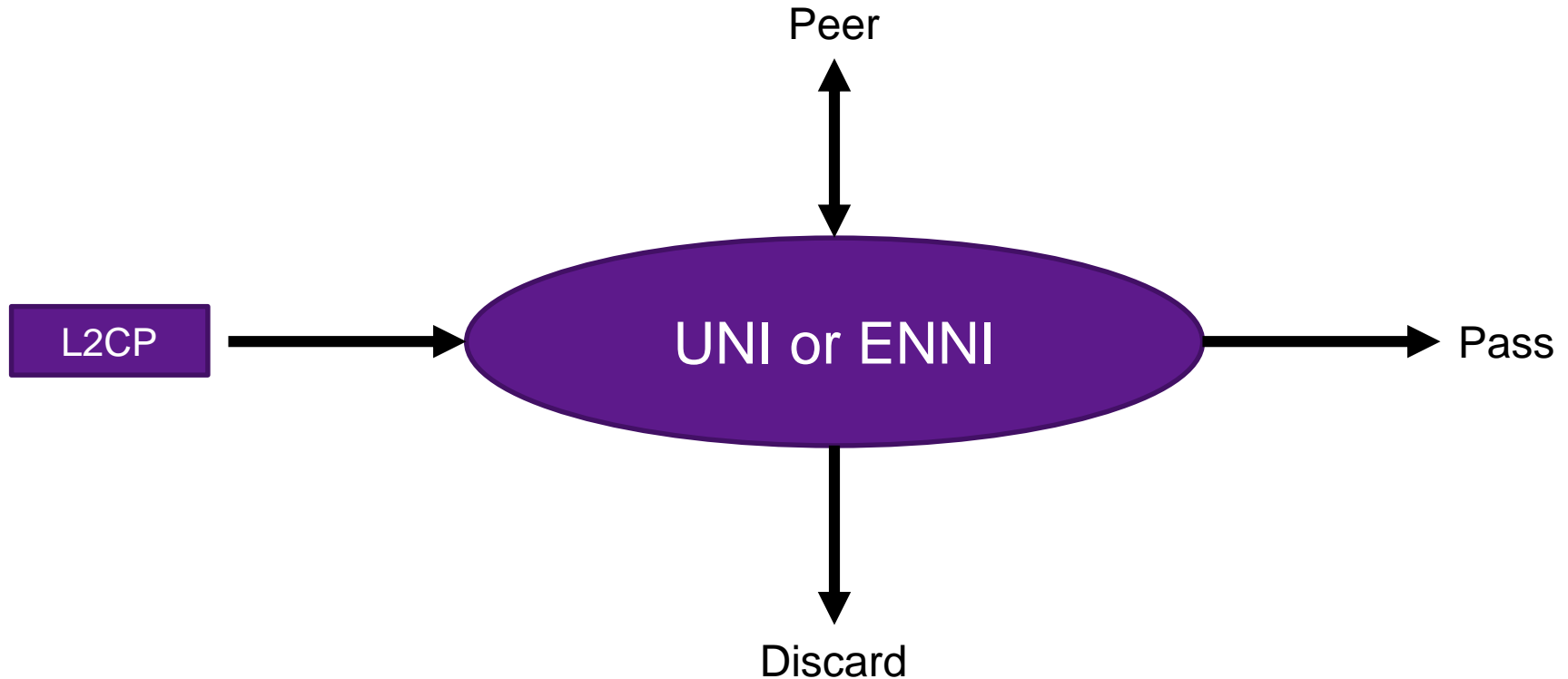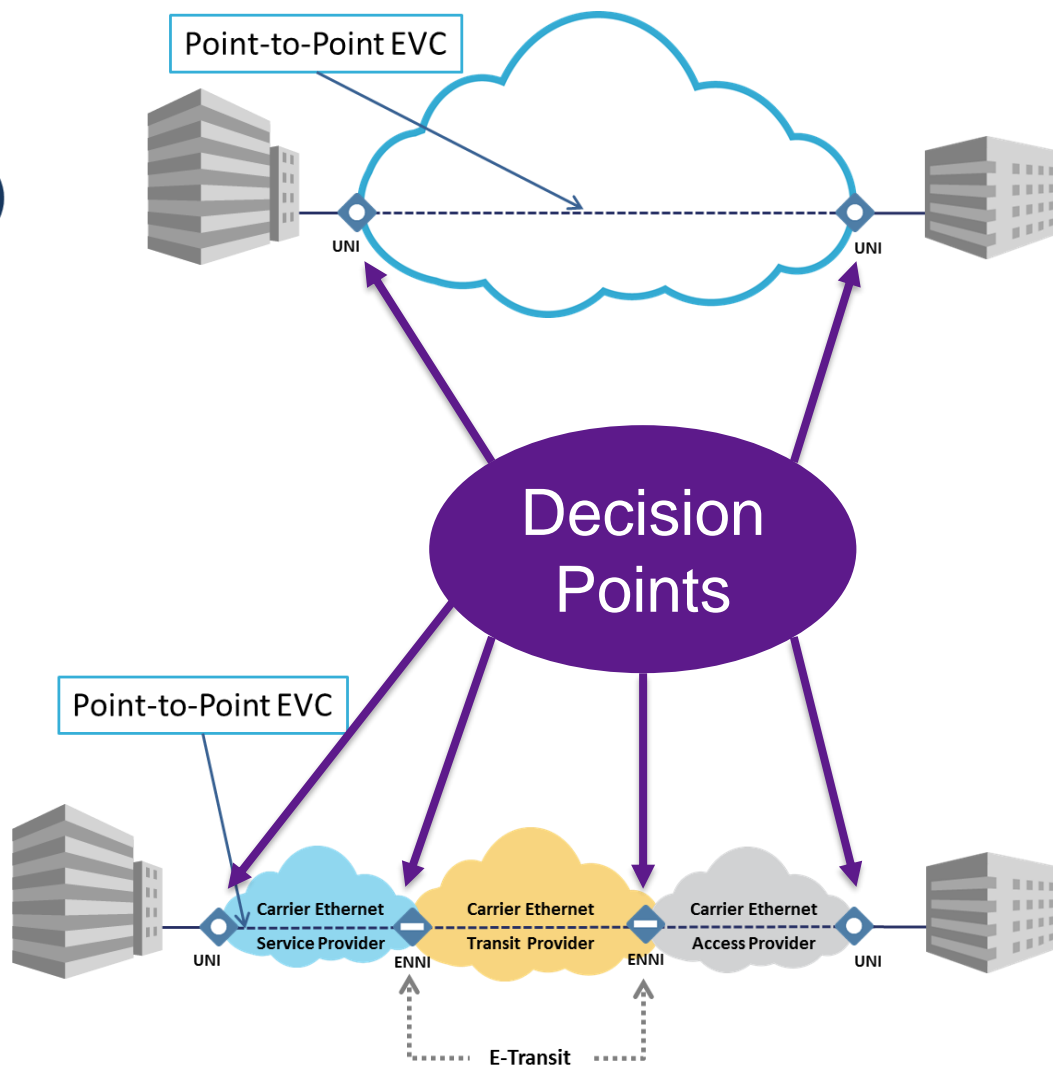
Source: MEF 45 Multi-CEN L2CP

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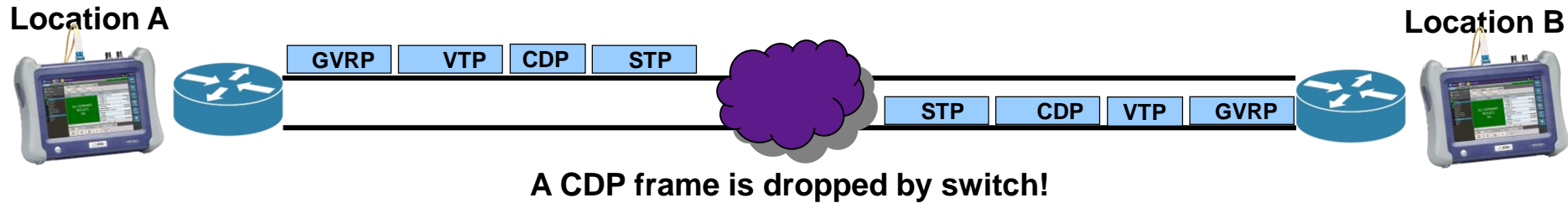# Decision Points for L2 Control Plane Frames

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

E-Transit
- **Wholesale Transit Services**
- **Transit E-Line**
- **Transit E-LAN**

Point-to-Point EVC

Decision Points

UNI

Point-to-Point EVC

UNI   Carrier Ethernet Service Provider   ENNI   Carrier Ethernet Transit Provider   ENNI   Carrier Ethernet Access Provider   UNI

E-Transit

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Viavi J-Proof – Layer 2 Control Plane Transparency Test

Location A

| GVRP | VTP | CDP | STP |

| STP | CDP | VTP | GVRP |

Location B

A CDP frame is dropped by switch!

- o J-Proof is a unique Viavi Pass/Fail test that validates Ethernet circuit Layer 2 Control Plane transparency
- o J-Proof simulates traffic of common Control Plane protocols and passes it thru the network end to end
- o 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

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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

More thorough testing now → fewer truck rolls later

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

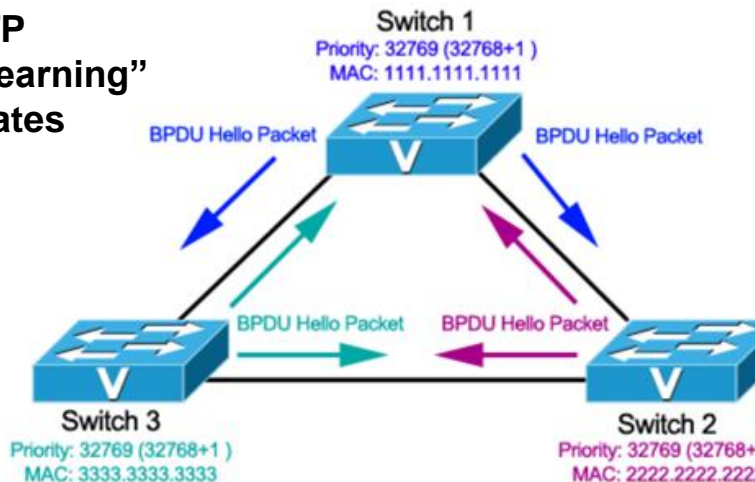# Ethernet Layer 2 Control Plane Protocol Summary

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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

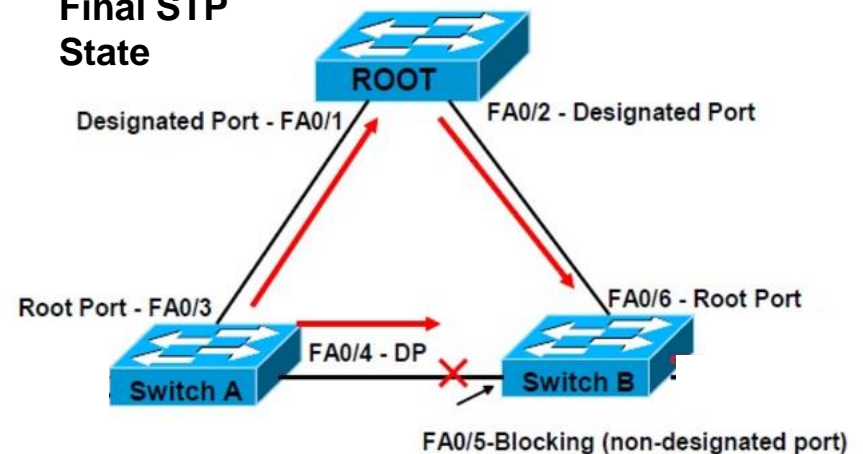- The next slides will highlight one from each category

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

Switch 1
Priority: 32769 (32768+1)
MAC: 1111.1111.1111

BPDU Hello Packet
BPDU Hello Packet
BPDU Hello Packet
BPDU Hello Packet

Switch 3
Priority: 32769 (32768+1)
MAC: 3333.3333.3333

Switch 2
Priority: 32769 (32768+
MAC: 2222.2222.222

Final STP State

ROOT

Designated Port - FA0/1
FA0/2 - Designated Port

Root Port - FA0/3
FA0/6 - Root Port

Switch A
FA0/4 - DP
Switch B

FA0/5-Blocking (non-designated port)

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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

Who are your neighbors?
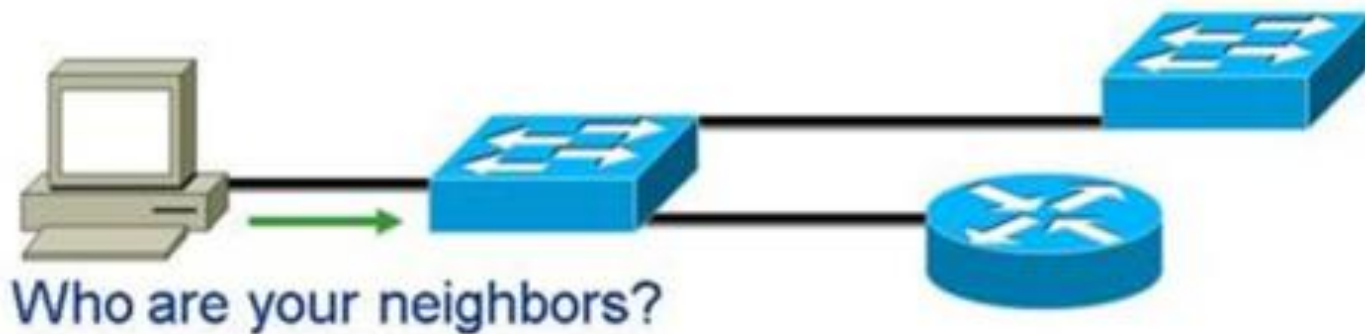
IEEE Protocols: LACP

- 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).
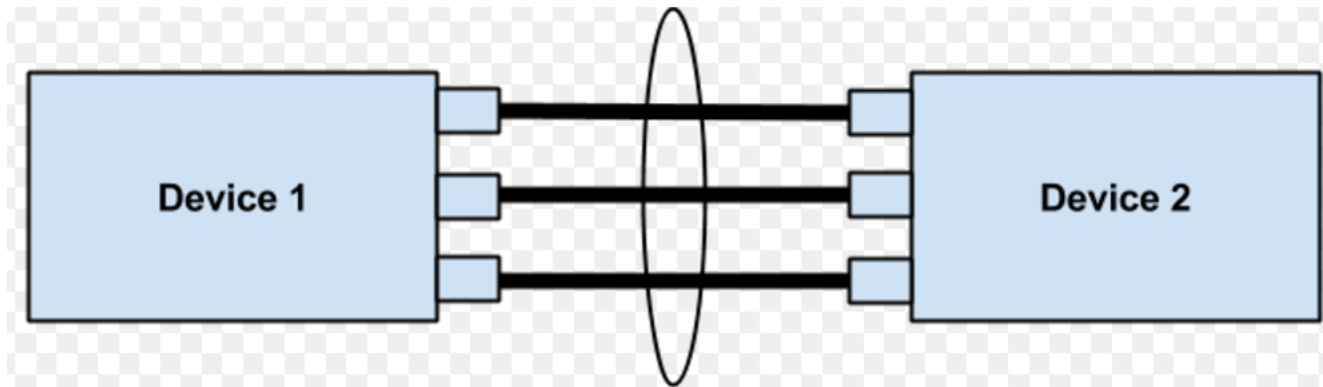
Device 1

Device 2

LAG formed using three links directly connected between two adjacent devices

Technical Summary of Popular Layer 2 Control Plane Protocols (1)

Control Protocol: Brief Description

GARP Multicast Registration Protocol (GMRP) is a Generic Attribute Registration Protocol (GARP) application that provides a constrained multicast flooding facility similar to IGMP snooping.

Multiple VLAN Registration Protocol (MVRP) 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.

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).

Cisco Discovery Protocol (CDP) 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.

VLAN Trunking Protocol (VTP) is a Cisco proprietary protocol that propagates the definition of Virtual Local Area Networks (VLAN) on the local area network.

Technical Summary of Popular Layer 2 Control Plane Protocols (2)

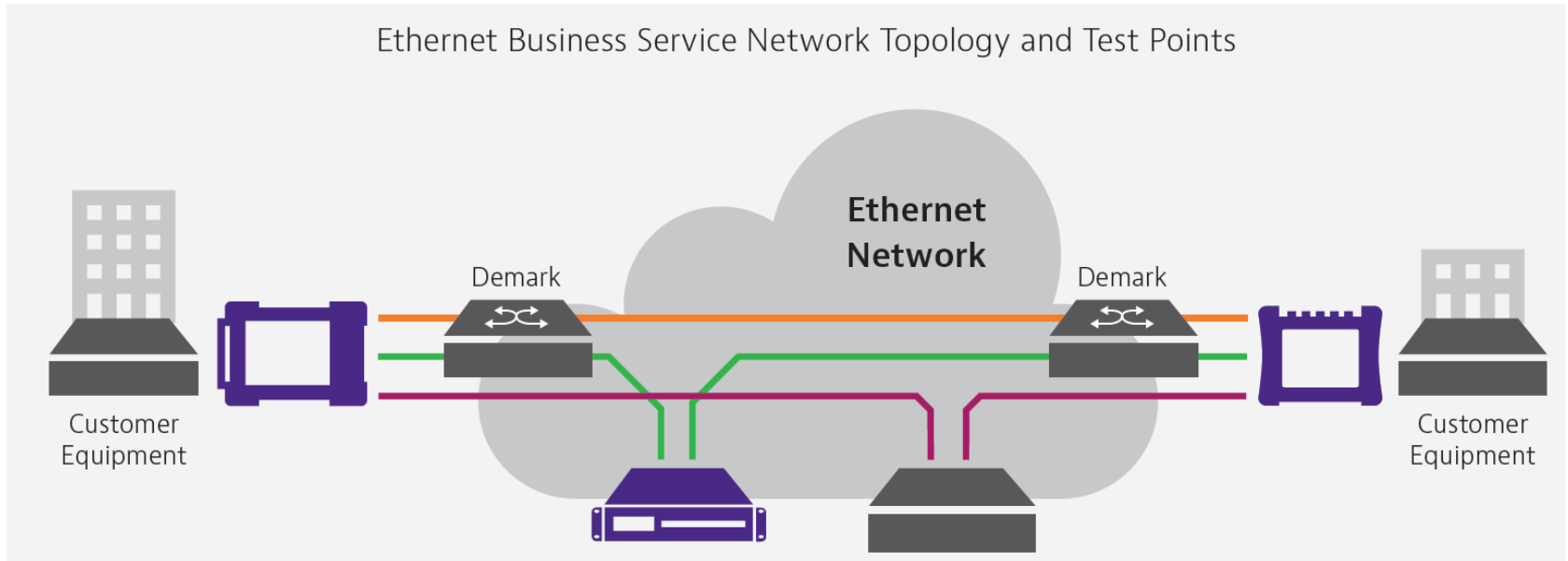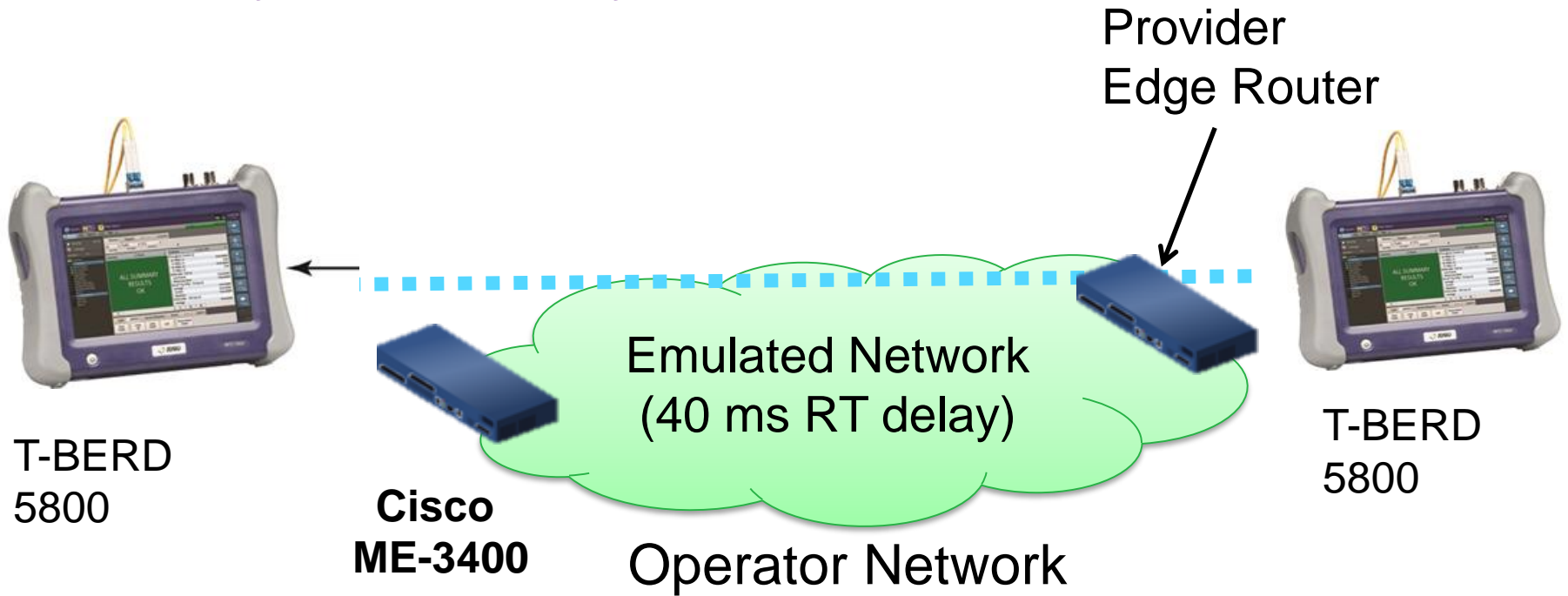| Control Protocol: Brief Description |
| --- |
| **Port Aggregation Protocol (PAgP)** is a Cisco Systems proprietary networking protocol, which is used for the automated, logical aggregation of Ethernet switch ports, known as an ether channel. The PAgP is proprietary to Cisco Systems. A similar protocol known as LACP |
| The **Dynamic Trunking Protocol (DTP)** 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. |
| The **Spanning Tree Protocol (STP)** 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. |
| 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. |

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Testing Scenarios and Demos

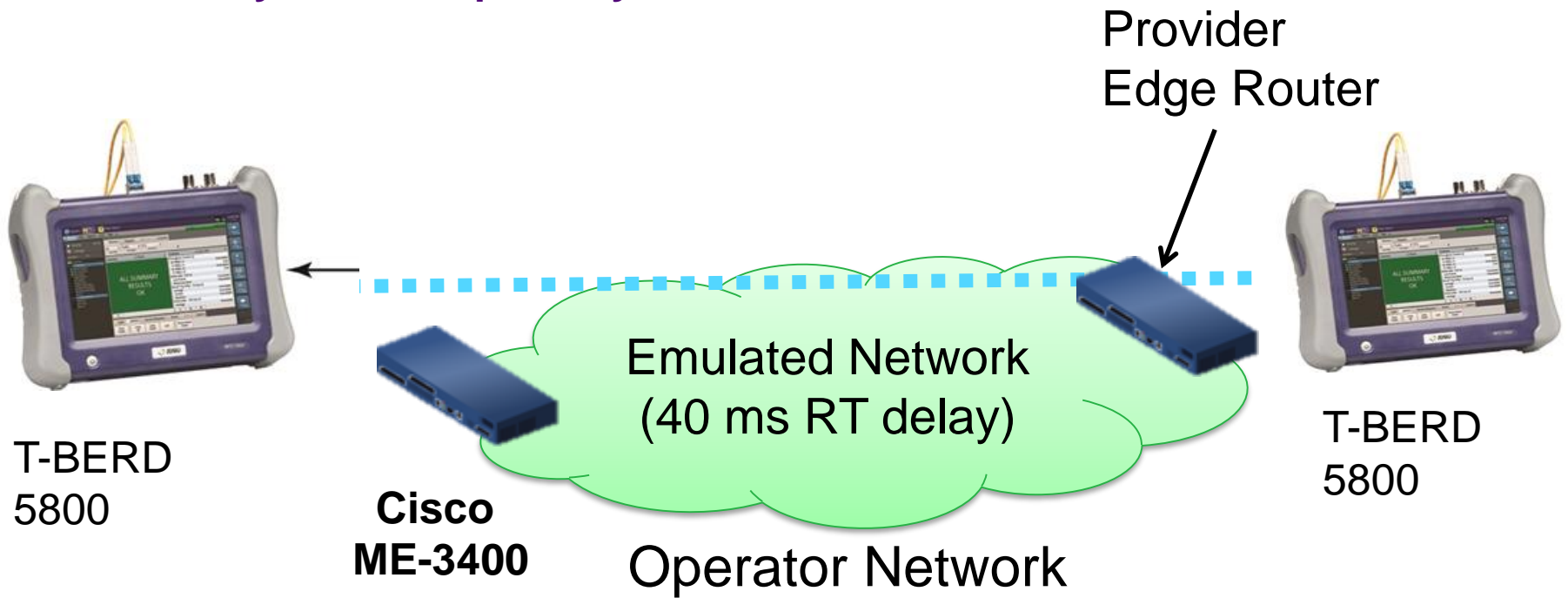VIAVI

Logical Ethernet Business Service Topology

Ethernet Business Service Network Topology and Test Points

Ethernet Network

Demark

Demark

Customer Equipment

Customer Equipment

J-Proof Layer 2 Transparency Demo #1

Provider Edge Router

Emulated Network
(40 ms RT delay)

T-BERD
5800

Cisco
ME-3400

Operator Network

T-BERD
5800

Network is Gigabit end-end with Cisco ME-3400 switch and default settings

J-Proof Layer 2 Transparency Demo #2

Provider
Edge Router

Emulated Network
(40 ms RT delay)

T-BERD
5800

Cisco
ME-3400

Operator Network

T-BERD
5800

Network is Gigabit end-end with Cisco ME-3400 switch
reconfigured to pass Layer 2 protocols transparently

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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)
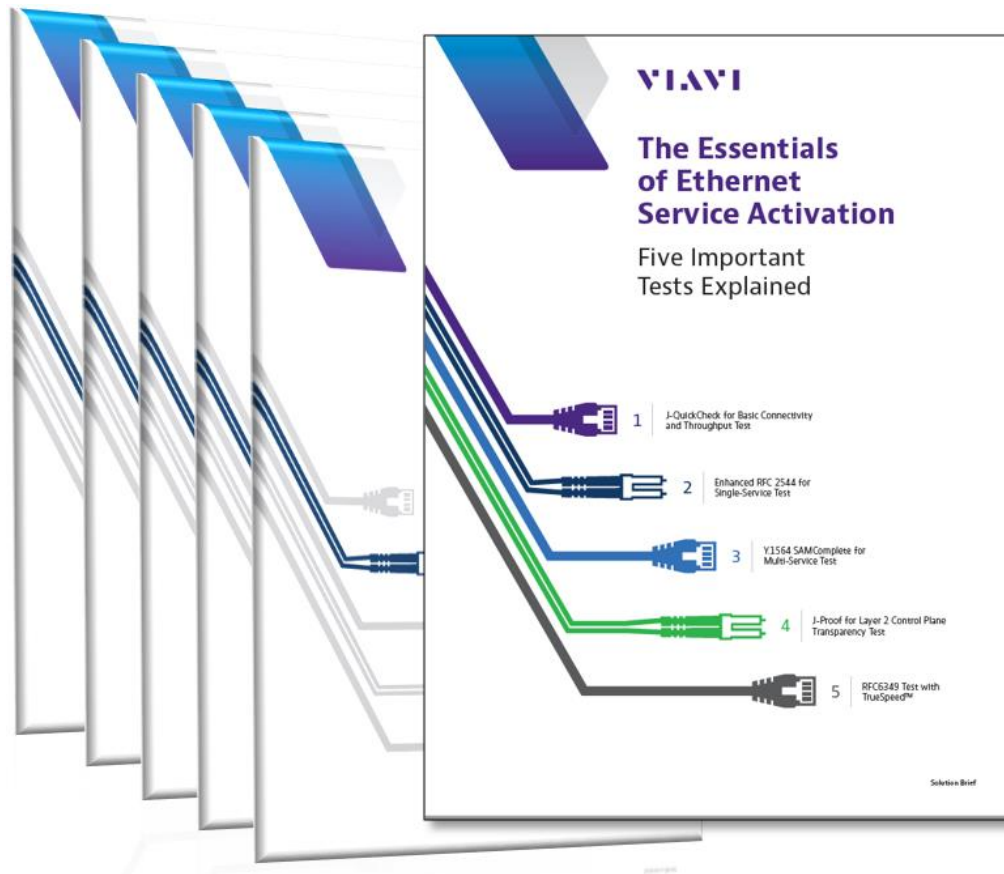
| J-QuickCheck Basic Connectivity Test | Y.1564 SAMComplete Ethernet KPI Verification for Multiple Services | J-Proof Layer 2 Control Plane Transparency Test: | RFC 6349 TrueSpeed Layer 4 TCP Throughput |

Multiple Class of Service (COS) Workflow

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Wrap-up and Q&A

The Essentials of Ethernet Service Activation

Five Important Tests Explained

1 J-QuickCheck for Basic Connectivity and Throughput Test
2 Enhanced RFC 2544 for Single-Service Test
3 Y.1564 SAMComplete for Multi-Service Test
4 J-Proof for Layer 2 Control Plane Transparency Test
5 RFC6349 Test with TrueSpeed™

Solution Brief

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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