

MEF

Introducing the Specifications of the MEF

**MEF 35.0.x: Service OAM Performance Monitoring
Implementation Agreement**

December 2013

Outline

- **Approved MEF Specifications**
- **This Presentation**
- **About this Specification**
- **Overview**
 - Maintenance Entities
- **PM Solutions**
- **PM Considerations**
- **Summary**

*Includes
information from
35.0.1
Amendment on
1SL and 35.0.2
Amendment on
Threshold
Crossing Alerts*

Approved MEF Specifications*

Specification	Description
MEF 2	Requirements and Framework for Ethernet Service Protection
MEF 3	Circuit Emulation Service Definitions, Framework and Requirements in Metro Ethernet Networks
MEF 4	Metro Ethernet Network Architecture Framework Part 1: Generic Framework
MEF 6.1	Metro Ethernet Services Definitions Phase 2
MEF 7.1	EMS-NMS Information Model Phase 2
MEF 8	Implementation Agreement for the Emulation of PDH Circuits over Metro Ethernet Networks
MEF 9	Abstract Test Suite for Ethernet Services at the UNI
MEF 10.2	Ethernet Services Attributes Phase 2
MEF 11	User Network Interface (UNI) Requirements and Framework
MEF 12.1	Metro Ethernet Network Architecture Framework Part 2: Ethernet Services Layer
MEF 13	User Network Interface (UNI) Type 1 Implementation Agreement
MEF 14	Abstract Test Suite for Traffic Management Phase 1
MEF 15	Requirements for Management of Metro Ethernet Phase 1 Network Elements
MEF 16	Ethernet Local Management Interface

*Current at time of publication. See MEF web site for official current list, minor updates and superseded work (such as MEF 1 and MEF 5)

Approved MEF Specifications

Specification	Description
MEF 17	Service OAM Framework and Requirements
MEF 18	Abstract Test Suite for Circuit Emulation Services
MEF 19	Abstract Test Suite for UNI Type 1
MEF 20	User Network Interface (UNI) Type 2 Implementation Agreement
MEF 21	Abstract Test Suite for UNI Type 2 Part 1: Link OAM
MEF 22.1	Mobile Backhaul Implementation Agreement Phase 2
MEF 23.1	Class of Service Implementation Agreement Phase 2
MEF 24	Abstract Test Suite for UNI Type 2 Part 2: E-LMI
MEF 25	Abstract Test Suite for UNI Type 2 Part 3: Service OAM
MEF 26.1	External Network Network Interface (ENNI) – Phase 2
MEF 27	Abstract Test Suite For UNI Type 2 Part 5: Enhanced UNI Attributes & Part 6: L2CP Handling
MEF 28	External Network Network Interface (ENNI) Support for UNI Tunnel Access and Virtual UNI
MEF 29	Ethernet Services Constructs

Approved MEF Specifications

Specification	Description
MEF 30	Service OAM Fault Management Implementation Agreement
MEF 31	Service OAM Fault Management Definition of Managed Objects
MEF 32	Requirements for Service Protection Across External Interfaces
MEF 33	Ethernet Access Services Definition
MEF 34	Abstract Test Suite for Ethernet Access Services
MEF 35	Service OAM Performance Monitoring Implementation Agreement
MEF 35.0.1	MEF 35 Amendment 1 – 1SL
MEF 35.0.2	MEF 35 Amendment 2 - TCA
MEF 36	Service OAM SNMP MIB for Performance Monitoring
MEF 37	Abstract Test Suite for ENNI

MEF 35 Specification Overview

MEF 35 Service OAM Performance Monitoring Implementation Agreement	
Purpose	An Implementation Agreement (IA) which provides for Service Operations, Administration, and Maintenance (SOAM) that satisfies and extends the Performance Monitoring (PM) framework and requirements described in MEF 17.
Audience	All, since it provides the fundamentals required to deliver Carrier Ethernet services.

MEF 35 Specification Overview

MEF 35.0.1 Service OAM Performance Monitoring Implementation Agreement Amendment 1	
Purpose	Amendment to MEF 35 to add a fourth (optional) PM solution providing support for Dual-Ended Synthetic Loss Measurement.
Audience	All, since it provides the fundamentals required to deliver Carrier Ethernet services.

MEF 35 Specification Overview

MEF 35.0.2 Service OAM Performance Monitoring Implementation Agreement Amendment 2	
Purpose	Amendment to MEF 35 to add support for threshold crossing alerts.
Audience	All, since it provides the fundamentals required to deliver Carrier Ethernet services.

Overview of MEF 35

About MEF 35

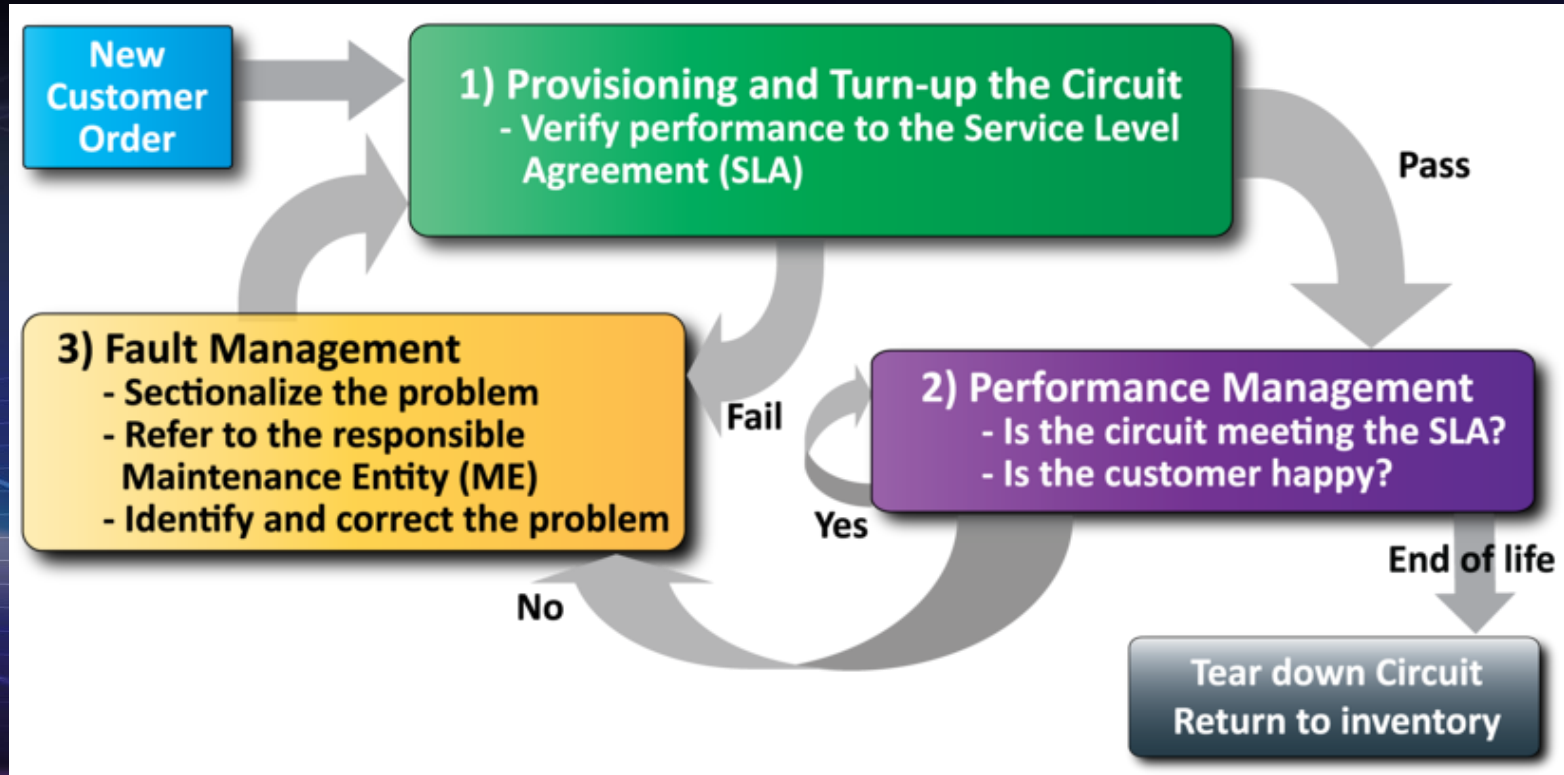
- **Purpose:**
 - This presentation is an introduction to MEF 35 – Service OAM Performance Monitoring Implementation Agreement
- **Audience**
 - Vendors building devices supporting OAM functions for Carrier Ethernet Services
 - Service Providers delivering Carrier Ethernet Services
- **Other Documents**
 - MEF 17 – Service OAM Framework and Requirements
 - MEF 30 – Service OAM Fault Management Implementation Agreement

Service OAM

- **MEF 17 provides the framework**
 - Relevant for Subscribers (customers), Operators and Service Providers
- **Fault Management IA (MEF 30)**
 - FM of MEF Services
 - Specifies profile of protocols defined in IEEE 802.1ag and ITU-T Y.1731
 - Provides basic SOAM architecture and requirements for each of the recommended MEGs
- **Performance Management IA (MEF 35)**
 - PM of MEF Services
 - Specifies profile of protocols defined in ITU-T Y.1731
- **Amendment for 1SL (MEF 35.0.1)**
 - Amendment to MEF 35 to add a fourth (optional) PM solution providing support for Dual-Ended Synthetic Loss Measurement.
- **Amendment for TCA (MEF 35.0.2)**
 - Amendment to MEF 35 to add support for threshold crossing alerts
- **Related Work**
 - MIBs (SNMP) for FM and PM covered in MEF 31 and MEF 36

MEF Service Lifecycle and SOAM

Network Management



Performance management is a critical part of a circuit's lifecycle

MEF 35 Specification Section Review

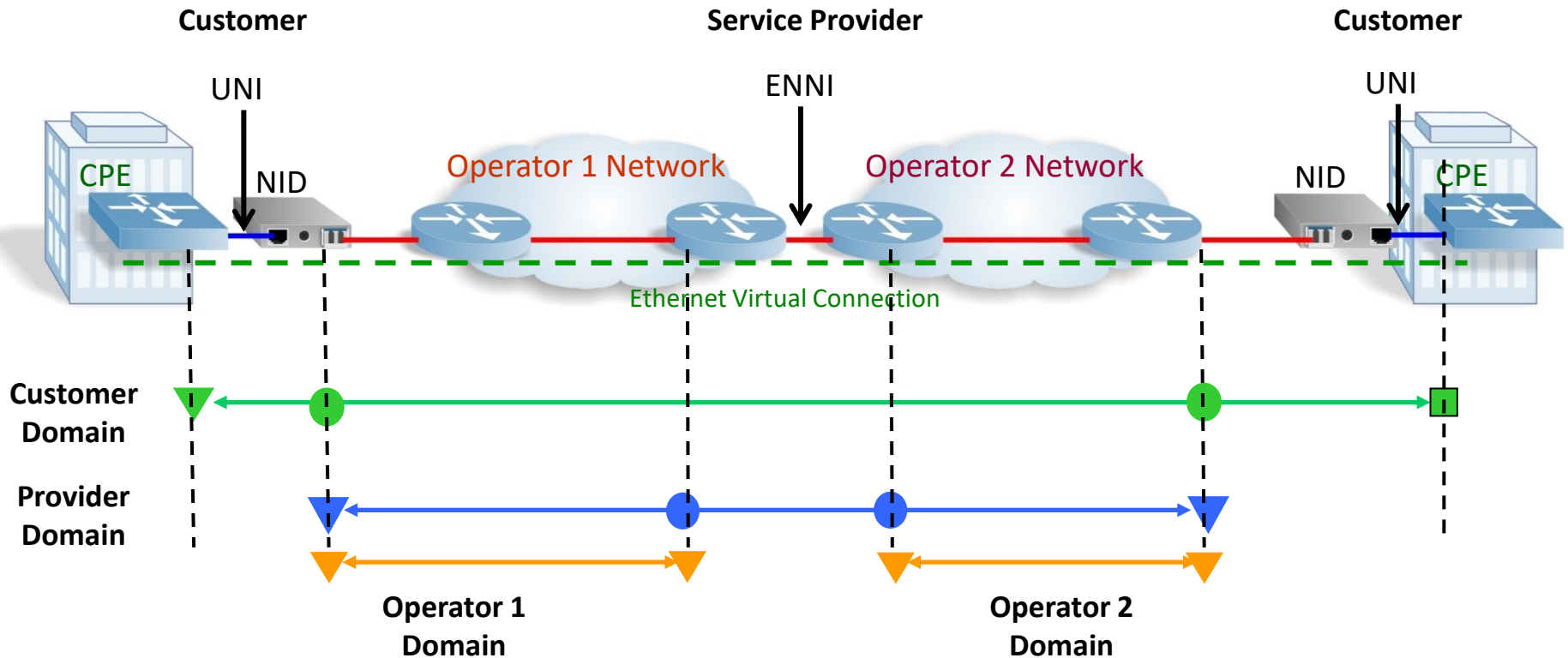
Introducing MEF 35

- **The presentation is organized into the following sections:**
 - Overview
 - Maintenance Entities
 - PM Solutions
 - PM Considerations

Performance Monitoring

- **Based on ITU-T Y.1731**
- **Protocols or Performance Monitoring mechanisms**
 - Frame Delay
 - Frame Delay Range
 - Inter-Frame Delay Variation
 - Frame Loss Ratio
 - Availability

Hierarchical OAM Domains

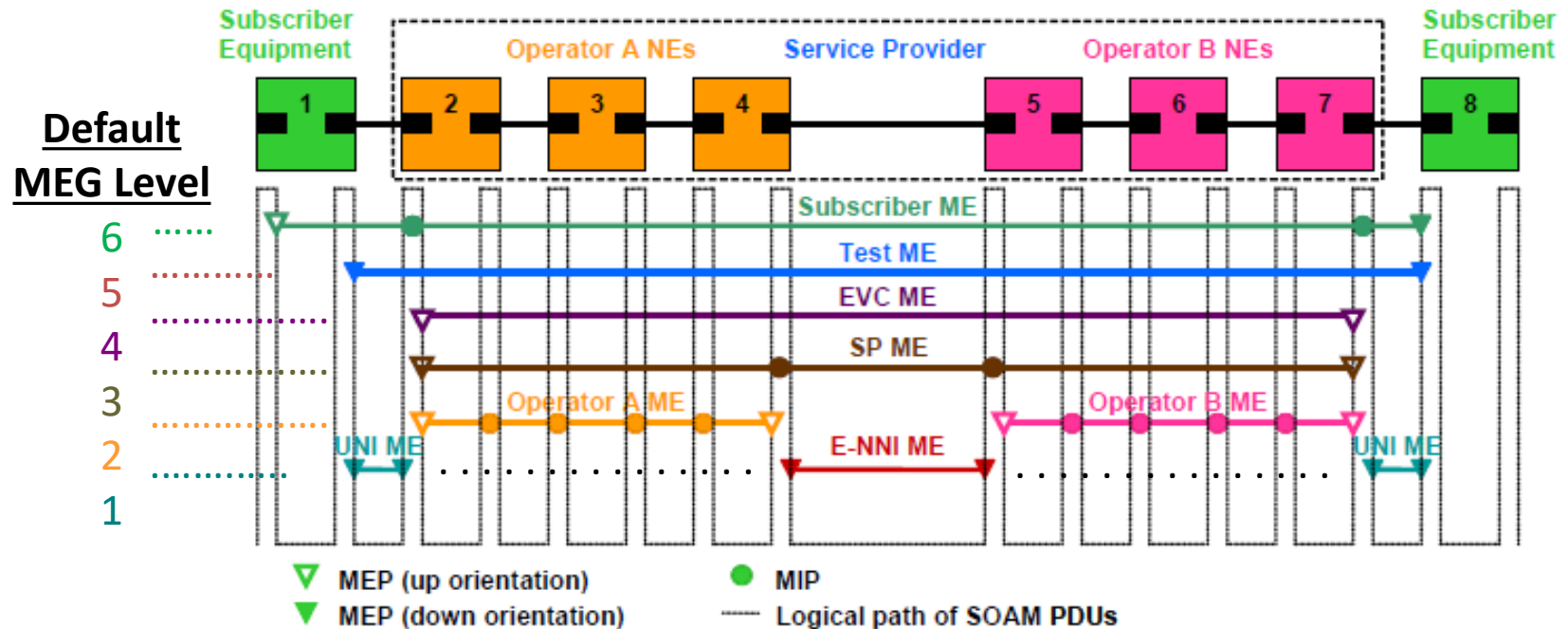


Hierarchical maintenance domains bind OAM flows & OAM responsibilities

Terminology and Concepts

- **MEF 35 builds upon MEF 17 and MEF 30 defined SOAM components including:**
 - Maintenance Entity (ME)
 - Maintenance Entity Group (MEG)
 - MEG End Point (MEP)
 - MEG Intermediate Point (MIP)
 - MEG Level
 - MEG Class of Service (CoS)
- **MEF 30 and MEF 35 are based on terminology found in ITU Y.1731**

Default MEG Level Usage

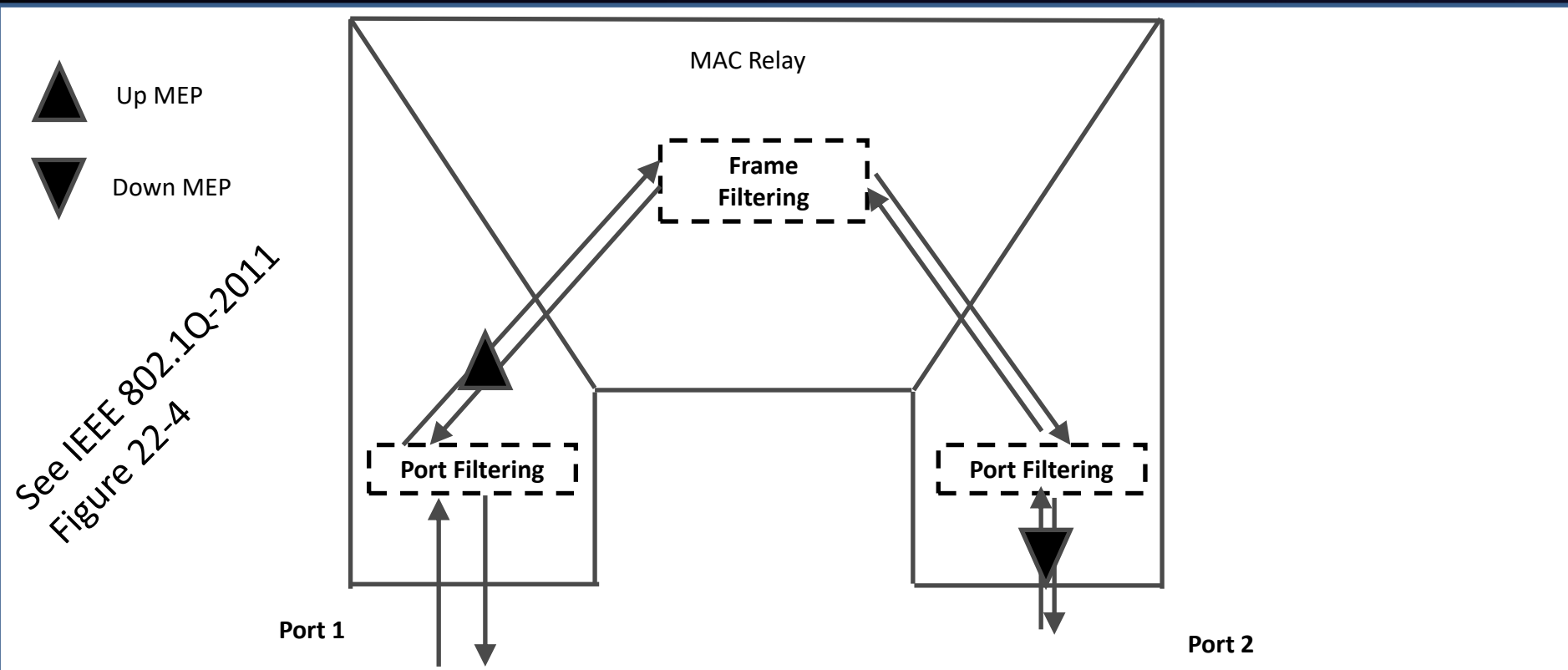


- This is the complete set of default MEG levels
- Not all MEG levels are required in every application

Key Maintenance Entity Groups (MEGs)

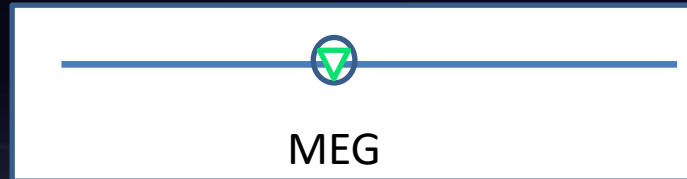
MEG	Suggested Use	Default Direction for MEPs	Default MEG Level
Subscriber MEG	Subscriber monitoring of an Ethernet service	Up or Down	6
Test MEG	Service Provider isolation of subscriber reported problems	Down	5
EVC MEG	Service Provider monitoring of provided service	Up	4
Service Provider MEG	Service Provider Monitoring of Service Provider network	Up	3
Operator MEG	Network Operator monitoring of their portion of a network	Up	2
UNI MEG	Service Provider monitoring of a UNI	Down	1
ENNI MEG	Network Operators' monitoring of an ENNI	Down	1

MEP Terminology



- **Up MEPs are positioned toward the MAC Relay**
 - Processes the OAM traffic that comes through the MAC Relay
- **Down MEPs are positioned toward the LAN**
 - Processes traffic that enters the Switch from the LAN

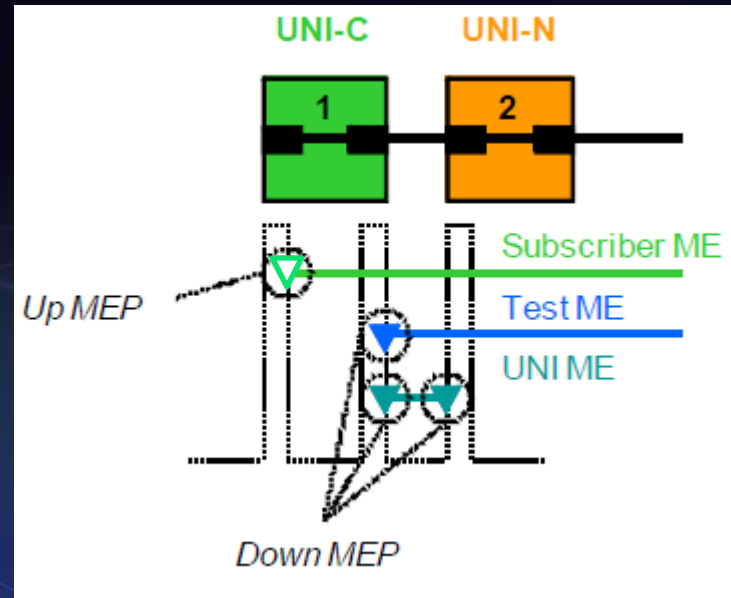
MEG End Point (MEP)



MEG End Point – MEP

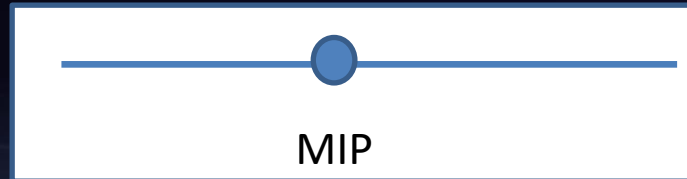
- SOAM points associated with a single MEG level (and a single Maintenance Domain)
- Can generate and respond to SOAM protocols
- Up MEPs are oriented toward the MAC Relay (non-filled triangle)
- Down MEPs are oriented toward the network (filled triangle)

MEG End Point (MEP) Orientation



- Down MEP - is a MEP residing in a Bridge that receives SOAM PDUs from, and transmits them towards, the direction of the LAN. Note that in the MEF service model, the LAN is a transmission facility in the egress direction, rather than towards the Bridge Relay Entity.
- Up MEP - is a MEP residing in a Bridge that transmits SOAM PDUs towards, and receives them from, the direction of the Bridge Relay Entity . Note that in the MEF service model, the Bridge Relay Entity itself is out of scope.
- A given MEG can be terminated by either Up or Down MEPs.
- Up MEPs are the most commonly used MEP and are recommended for the following MEG levels: EVC, Service Provider, Operator and optionally the Subscriber.

MEG Intermediate Point (MIP)



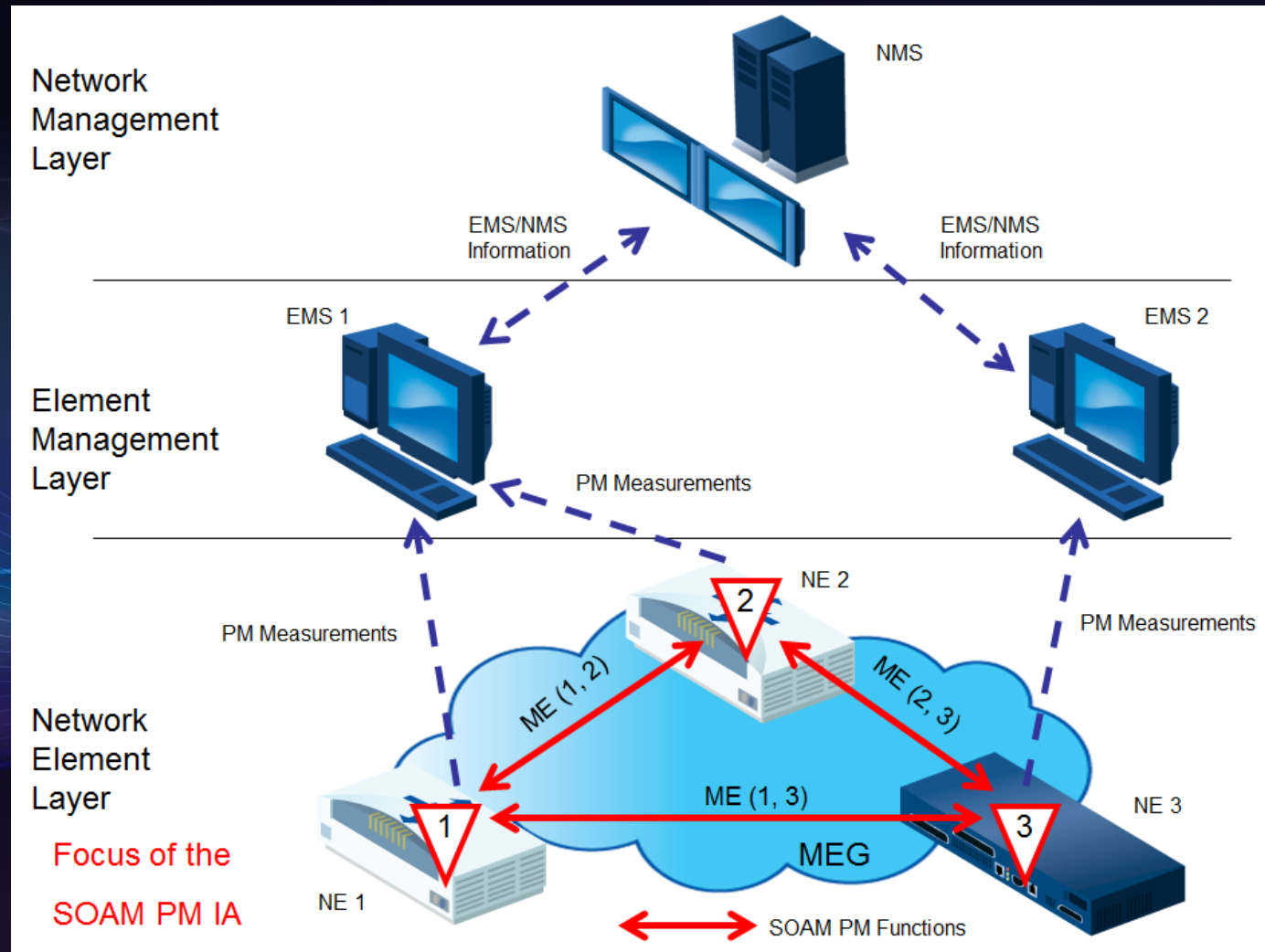
MEG Intermediate Point – MIP

- SOAM points associated with a single MEG level (and a single Maintenance Domain)
- Can respond to SOAM protocols, but cannot generate requests
- Defined to be located at External Interfaces such as ENNs (or UNIs). In practice can also be used in additional internal operator locations where monitoring is desired

PM Sessions

PM Solution Components

- SOAM PM IA Focused on the Network Element Layer
- A PM Solution is made up of one or more PM Functions



PM Solutions

- There are four PM Solutions defined, each with different characteristics
- A PM Solution uses PM Functions which use the PM tools defined in ITU-T Y.1731

PM Solution	MEG Type(s)	Measurement Technique for Loss	PM Function(s)	Mandatory or Optional
PM-1	point-to-point multipoint	Synthetic Testing	Single-Ended Delay Single-Ended Synthetic Loss	Mandatory
PM-2	point-to-point multipoint	n/a	Dual-Ended Delay	Optional
PM-3	point-to-point	Counting Service Frames	Single-Ended Service Loss	Optional
PM-4 (35.0.1)	point-to-point multipoint	Synthetic Testing	Dual-Ended Synthetic Loss	Optional

PM Function	ITU-T PM Tool	ITU-T PDU(s)
Single-Ended Delay	ITU-T Two-way ETH-DM	DMM/DMR
Dual-Ended Delay	ITU-T One-way ETH-DM	1DM
Single-Ended Service Loss	ITU-T Single-Ended ETH-LM	LMM/LMR
Single-Ended Synthetic Loss	ITU-T Single-Ended ETH-SLM	SLM/SLR
Dual-Ended Synthetic Loss	ITU-T Dual-Ended ETH-SLM	1SL

Single-Ended Functions

Single-Ended
Function
initiated at A



Single-Ended ETH-xM PM tool;
uses SOAM PM PDUs: DMM/DMR, LMM/LMR, SLM/SLR

This can be used to produce measurements for the following metrics :

- One-way FD (forward and backward)
- One-way IFDV (forward and backward)
- One-way FDR (forward and backward)
- Two-way FD
- Two-way IFDV
- Two-way FDR
- One-way FLR (forward and backward), using LMM/LMR
- One-way FLR (forward and backward), using SLM/SLR

Dual-Ended Functions

Dual-Ended
Function initiated at
A (and optionally at
B)



Dual-Ended ETH-xM PM tool;
uses PDU: 1DM

This can be used to produce metrics for:

- One-way FD (forward)
- One-way IFDV (forward)
- One-way FDR (forward)

PM Solutions

- **PM-1**
 - Single-Ended Point-to-Point or Multipoint Delay and Synthetic Loss
 - Single-Ended functions send messages from a Controller MEP to a Responder MEP which responds back to the Controller MEP
 - Metrics Collected
 - One-way Frame Delay
 - One-way Mean Frame Delay
 - One-way Frame Delay Range
 - Inter-Frame Delay Variation
 - One-way Frame Loss Ratio
 - Availability for an EVC or OVC
 - Resiliency-related metrics for EVC or OVC

PM Solutions (continued)

- **PM-2**

- Dual-Ended Point-to-Point or Multipoint Delay
- Dual-Ended functions send measurements from a Controller MEP to a Sink MEP where the calculations are made
- Metrics Collected
 - One-way Frame Delay
 - One-way Mean Frame Delay
 - One-way Frame Delay Range
 - Inter-Frame Delay Variation

- **PM-3**

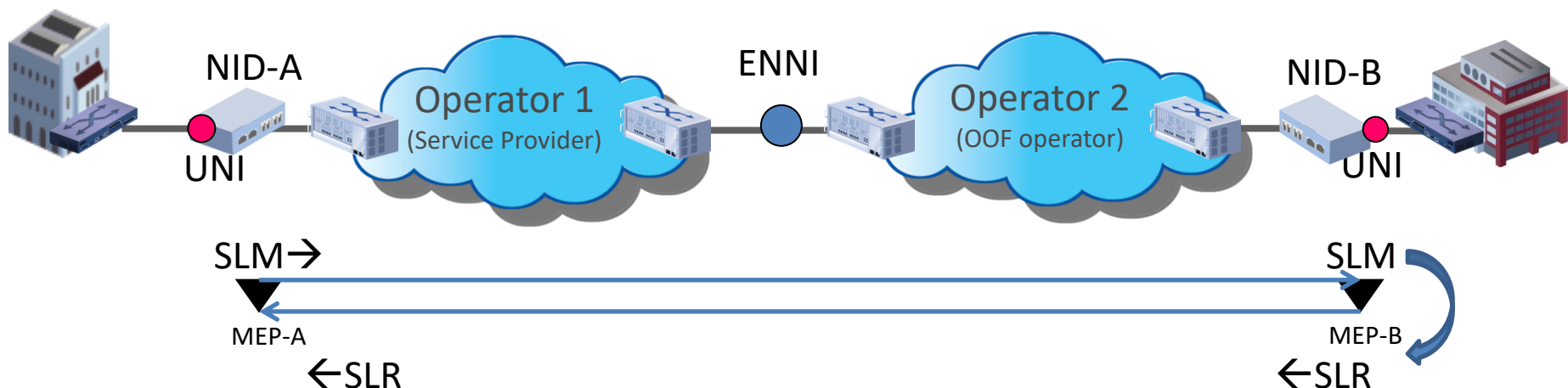
- Single-Ended Service Loss Measurement
- This solution uses the service traffic instead of synthetic traffic
- Metrics Collected
 - One-way Frame Loss Ratio

PM Solutions (continued)

- **PM-4 (35.0.1)**
 - Dual-Ended Point-to-Point or Multipoint Delay
 - Dual-Ended functions send measurements from a Controller MEP to a Sink MEP where the calculations are made
 - Metrics Collected
 - One-way Frame Loss

PM-1 Example

Single-Ended Synthetic Loss Measurement



- **SLM Message created at the Controller MEP (at MEP-A)**
 - TestID is in the PDU to differentiate
 - Source MEP ID
 - Value of local counter (at MEP-A) containing the number of SLM messages sent
- **SLR Message is created at the Responder MEP (at MEP-B)**
 - Received counts are copied
 - Local counter of received SLM messages are sent back to the Controller MEP
- **Frame Loss is calculated at the Controller MEP**

Threshold Crossing Alert

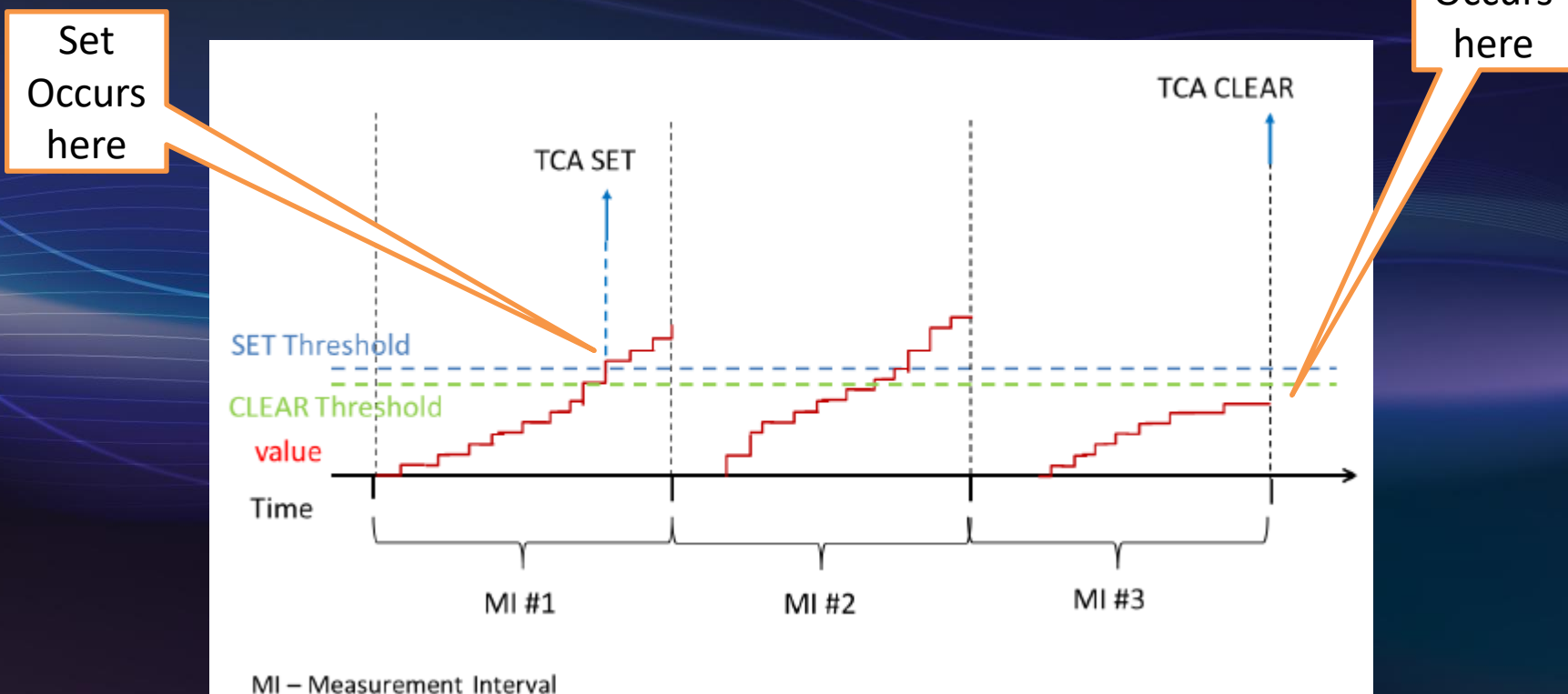
MEF 35.0.2

Threshold Crossing Alerts

- A threshold is associated with a particular performance metric
- When the measured value of a metric reaches or exceeds a configured value an alert can be generated
- Two types of reporting are supported (stateful and stateless)

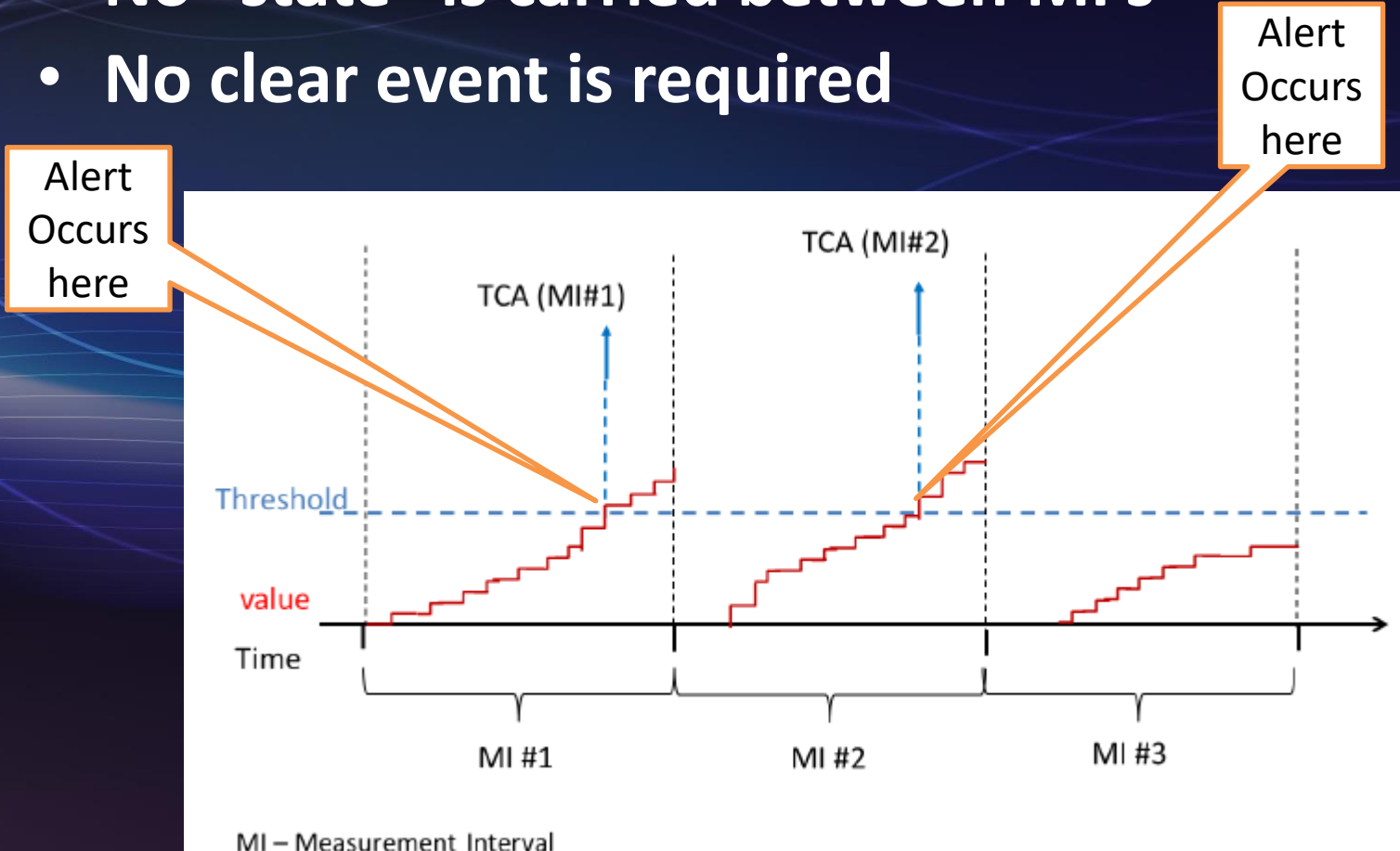
Stateful Reporting Example

- Once set, the TCA will not generate again until the alert has been cleared.



Stateless Reporting Example

- Each Measurement interval is treated separately
- No “state” is carried between MI’s
- No clear event is required



Summary

Related Specifications

- **MEF 35 section 6 lists a full list of related MEF specifications**
- **MEF 30 SOAM FM**
- **MEF 31 SOAM FM MIB**
- **MEF 36 SOAM PM MIB**
- **ITU-T Y.1731**
- **MEF 17 SOAM requirements and frameworks phase 1**
- **MEF 12.1 Carrier Ethernet Network Architecture Part 2 – ETH Service Layer**

Final Word

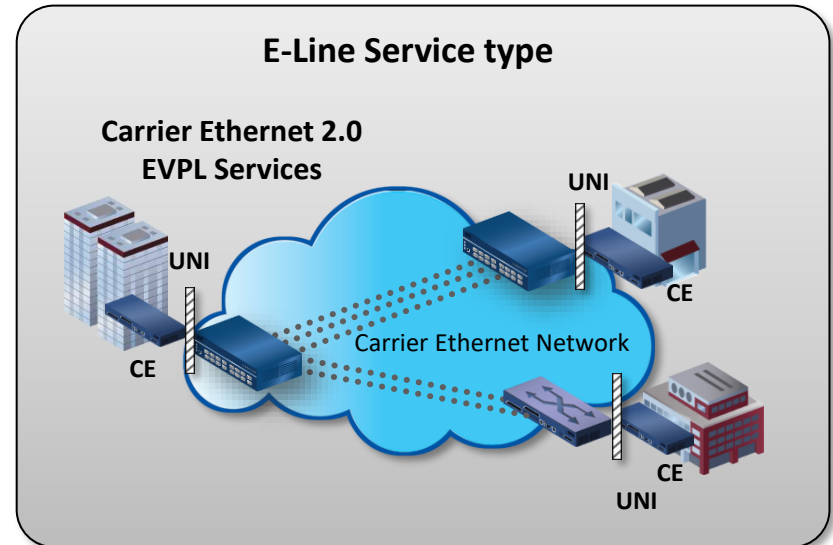
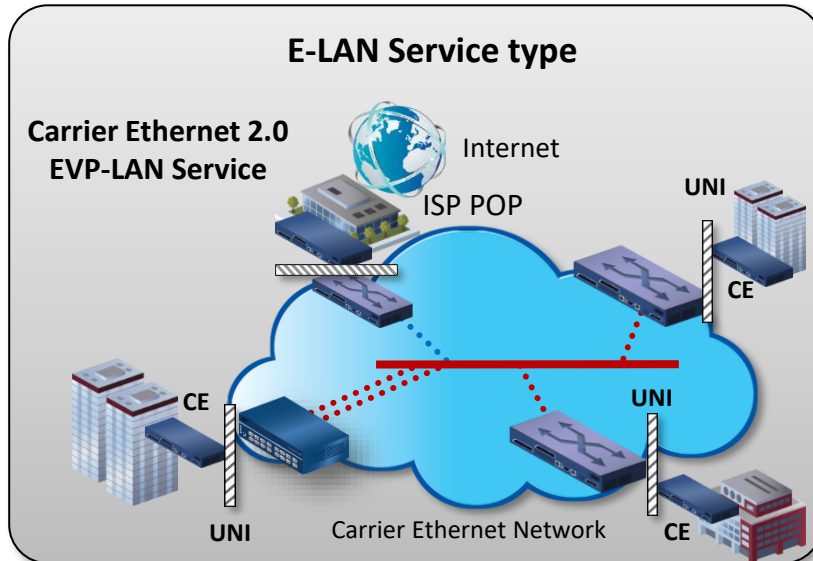
- **Service OAM**
 - In the context of MEF 35, mechanisms are defined that support service-level OAM in MENs.
- **Next Actions**
 - Read the MEF 35 specification
 - Read the MEF 30 specification
 - Read IEEE 802.1Q-2011 clauses 18, 19, 29, 21, and 22
 - Read ITU-T Y.1731
 - Review of MEF 17, MEF 10 and MEF 15 may also be helpful
 - Understand the principal service OAM components and capabilities
 - Review also MEF 36, MEF 31 and MEF 12.1 specification

For Full Details ...

Please visit

www.metroethernetforum.org

Select Information Center on Left
Navigation to access the full specification
and extracted MIB files



EVC: Ethernet Virtual Connection

UNI: User Network Interface. the physical demarcation point between the responsibility of the Service Provider and the responsibility of the End-User/Subscriber

CE Customer Equipment

MEF

*Accelerating Worldwide Adoption of
Carrier-class Ethernet Networks and Services*

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