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 Amendment on Threshold Crossing Alerts
Includes information from 35.0.1 and 35.0.2
### Approved MEF Specifications*

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

*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 See MEF web site for official current list, minor updates and superseded work (such as MEF 1 and MEF 5)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

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEF 17</td>
<td>Service OAM Framework and Requirements</td>
</tr>
<tr>
<td>MEF 18</td>
<td>Abstract Test Suite for Circuit Emulation Services</td>
</tr>
<tr>
<td>MEF 19</td>
<td>Abstract Test Suite for UNI Type 1</td>
</tr>
<tr>
<td>MEF 20</td>
<td>User Network Interface (UNI) Type 2 Implementation Agreement</td>
</tr>
<tr>
<td>MEF 21</td>
<td>Abstract Test Suite for UNI Type 2 Part 1: Link OAM</td>
</tr>
<tr>
<td>MEF 22.1</td>
<td>Mobile Backhaul Implementation Agreement Phase 2</td>
</tr>
<tr>
<td>MEF 23.1</td>
<td>Class of Service Implementation Agreement Phase 2</td>
</tr>
<tr>
<td>MEF 24</td>
<td>Abstract Test Suite for UNI Type 2 Part 2: E-LMI</td>
</tr>
<tr>
<td>MEF 25</td>
<td>Abstract Test Suite for UNI Type 2 Part 3: Service OAM</td>
</tr>
<tr>
<td>MEF 26.1</td>
<td>External Network Network Interface (ENNI) – Phase 2</td>
</tr>
<tr>
<td>MEF 27</td>
<td>Abstract Test Suite For UNI Type 2 Part 5: Enhanced UNI Attributes &amp; Part 6: L2CP Handling</td>
</tr>
<tr>
<td>MEF 28</td>
<td>External Network Network Interface (ENNI) Support for UNI Tunnel Access and Virtual UNI</td>
</tr>
<tr>
<td>MEF 29</td>
<td>Ethernet Services Constructs</td>
</tr>
<tr>
<td>Specification</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>MEF 30</td>
<td>Service OAM Fault Management Implementation Agreement</td>
</tr>
<tr>
<td>MEF 31</td>
<td>Service OAM Fault Management Definition of Managed Objects</td>
</tr>
<tr>
<td>MEF 32</td>
<td>Requirements for Service Protection Across External Interfaces</td>
</tr>
<tr>
<td>MEF 33</td>
<td>Ethernet Access Services Definition</td>
</tr>
<tr>
<td>MEF 34</td>
<td>Abstract Test Suite for Ethernet Access Services</td>
</tr>
<tr>
<td><strong>MEF 35</strong></td>
<td>Service OAM Performance Monitoring Implementation Agreement</td>
</tr>
<tr>
<td>MEF 35.0.1</td>
<td>MEF 35 Amendment 1 – 1SL</td>
</tr>
<tr>
<td>MEF 35.0.2</td>
<td>MEF 35 Amendment 2 - TCA</td>
</tr>
<tr>
<td>MEF 36</td>
<td>Service OAM SNMP MIB for Performance Monitoring</td>
</tr>
<tr>
<td>MEF 37</td>
<td>Abstract Test Suite for ENNI</td>
</tr>
</tbody>
</table>
## MEF 35 Specification Overview

<table>
<thead>
<tr>
<th>MEF 35</th>
<th>Service OAM Performance Monitoring Implementation Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Audience</strong></td>
<td>All, since it provides the fundamentals required to deliver Carrier Ethernet services.</td>
</tr>
</tbody>
</table>
# MEF 35 Specification Overview

<table>
<thead>
<tr>
<th>MEF 35.0.1</th>
<th>Service OAM Performance Monitoring Implementation Agreement Amendment 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Amendment to MEF 35 to add a fourth (optional) PM solution providing support for Dual-Ended Synthetic Loss Measurement.</td>
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</tr>
</tbody>
</table>
## MEF 35 Specification Overview

<table>
<thead>
<tr>
<th>MEF 35.0.2</th>
<th>Service OAM Performance Monitoring Implementation Agreement Amendment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Amendment to MEF 35 to add support for threshold crossing alerts.</td>
</tr>
<tr>
<td><strong>Audience</strong></td>
<td>All, since it provides the fundamentals required to deliver Carrier Ethernet services.</td>
</tr>
</tbody>
</table>
Overview of 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
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
This is the complete set of default MEG levels
Not all MEG levels are required in every application
## Key Maintenance Entity Groups (MEGs)

<table>
<thead>
<tr>
<th>MEG</th>
<th>Suggested Use</th>
<th>Default Direction for MEPs</th>
<th>Default MEG Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subscriber MEG</td>
<td>Subscriber monitoring of an Ethernet service</td>
<td>Up or Down</td>
<td>6</td>
</tr>
<tr>
<td>Test MEG</td>
<td>Service Provider isolation of subscriber reported problems</td>
<td>Down</td>
<td>5</td>
</tr>
<tr>
<td>EVC MEG</td>
<td>Service Provider monitoring of provided service</td>
<td>Up</td>
<td>4</td>
</tr>
<tr>
<td>Service Provider MEG</td>
<td>Service Provider Monitoring of Service Provider network</td>
<td>Up</td>
<td>3</td>
</tr>
<tr>
<td>Operator MEG</td>
<td>Network Operator monitoring of their portion of a network</td>
<td>Up</td>
<td>2</td>
</tr>
<tr>
<td>UNI MEG</td>
<td>Service Provider monitoring of a UNI</td>
<td>Down</td>
<td>1</td>
</tr>
<tr>
<td>ENNI MEG</td>
<td>Network Operators' monitoring of an ENNI</td>
<td>Down</td>
<td>1</td>
</tr>
</tbody>
</table>
• **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

• 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

- 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 ENNIs (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

Focus of the SOAM PM IA

Network Element Layer

Element Management Layer

Network Management Layer

EMS/NMS Information

EMS 1

EMS 2

EMS/NMS Information

MEG

ME 1

ME 2

ME 3

ME (1, 2)

ME (1, 3)

ME (2, 3)

NE 1

NE 2

NE 3

PM Measurements

SOAM PM Functions
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.

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

<table>
<thead>
<tr>
<th>PM Function</th>
<th>ITU-T PM Tool</th>
<th>ITU-T PDU(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Ended Delay</td>
<td>ITU-T Two-way ETH-DM</td>
<td>DMM/DMR</td>
</tr>
<tr>
<td>Dual-Ended Delay</td>
<td>ITU-T One-way ETH-DM</td>
<td>1DM</td>
</tr>
<tr>
<td>Single-Ended Synthetic Loss</td>
<td>ITU-T Single-Ended ETH-SLM</td>
<td>SLM/SLR</td>
</tr>
<tr>
<td>Dual-Ended Synthetic Loss</td>
<td>ITU-T Dual-Ended ETH-SLM</td>
<td>1SL</td>
</tr>
</tbody>
</table>
Single-Ended Functions

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
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](http://www.metroethernetforum.org)
Select Information Center on Left Navigation to access the full specification and extracted MIB files

**Carrier Ethernet Network**

**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

**EVC**: Ethernet Virtual Connection

**E-Line Service type**

**EVP-LAN Service**

ISP POP

UNI

CE

UNI

Carrier Ethernet Network

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

www.MetroEthernetForum.org