Introducing the Specifications of the MEF

MEF 38: Service OAM Fault Management YANG Modules Technical Specification

April 2012
MEF Reference Presentations

• Intention
  – These MEF reference presentations are intended to give general overviews of the MEF work and have been approved by the MEF Marketing Committee
  – Further details on the topic are to be found in related specifications, technical overviews, white papers in the MEF public site Information Center:
    http://metroethernetforum.org/InformationCenter

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Outline

• Approved MEF Specifications
• This presentation
• About this Specification
• In Scope / Out of Scope
• Terminology, Concepts & Relationship to other standards
• Section Review
  – Major topics
    • Minor topics
• Examples/Use Cases
• Summary
<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 See MEF web site for official current list, minor updates and superseded work (such as MEF 1 and MEF 5)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>MEF 35</td>
<td>Service OAM Performance Monitoring Implementation Agreement</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>
<tr>
<td><strong>MEF 38</strong></td>
<td><strong>Service OAM Fault Management YANG Modules Technical Specification</strong></td>
</tr>
<tr>
<td>MEF 39</td>
<td>Service OAM Performance Monitoring YANG Modules Technical Specifications</td>
</tr>
</tbody>
</table>
# MEF 38 Specification Overview

<table>
<thead>
<tr>
<th>MEF 38</th>
<th>Service OAM Fault Management YANG Modules Technical Spec</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 Specification Overview

<table>
<thead>
<tr>
<th>MEF 38 - Service OAM Fault Management YANG Modules Technical Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
</tr>
<tr>
<td><strong>Audience</strong></td>
</tr>
</tbody>
</table>
Overview of MEF 38
About MEF 38

• **Purpose:**
  – This presentation is an introduction to MEF 38 - Service OAM Fault Management YANG Modules

• **Audience**
  – Equipment Manufacturers building devices that will carry Carrier Ethernet Services
  – Service Providers delivering Carrier Ethernet Services
  – EMS/NMS/OSS tool vendors developing back office applications for managing Carrier Ethernet Services

• **Other Documents**
  – Presentations of other MEF specifications and an overview of all specifications is available on the MEF web site
  – Other materials such as white papers and case studies are also available
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 802.1Q 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

- **MEF 31 & MEF 36**
  - SNMP MIBs (Definition of Management Objects) for FM (MEF 31) and PM (MEF 36)
  - Provides data models for SNMP-based network management
MEF 38 - In Scope/Out of Scope

- MEF 38 requirements are primarily driven by MEF 30 and leverage the OAM functions & managed objects defined by MEF 31, IEEE 802.1Q and ITU-T Y.1731
- Managed objects to perform Fault Management functions such as Continuity Check, Loopback and Link Trace are covered in this Technical Specification
- SOAM Performance Management capabilities are covered in MEF 39
• **MEF 38 adheres to MEF 30 terminology:**
  – Refer to MEF 30 for ME, MEG, MEP, MIP, MEG Level, MEG CoS
  – Continuity Check Message (CCM)
  – Alarm Indication Signal (AIS)
  – Remote Defect Indication (RDI)

• **MEF 38 introduces protocol specific terminology**
  – Network Configuration Protocol (NETCONF)
  – NETCONF Client/Server
  – YANG Data Modeling Language and Modules
  – Element/Network Management System (EMS/NMS)
  – Operations Support System (OSS)
  – Remote Procedure Call (RPC)
  – Extensible Markup Language (XML)
  – Secure Shell (SSH)

**MEF-30 aligns with terminology found in ITU Y.1731**
Relationship with other Specifications
Fault management is a critical part of a circuit’s lifecycle
Introducing MEF 38

• The presentation is broken into sections:
  – Overview
  – Network Management Concepts/Topologies
  – Initial Configuration
  – OAM Functions
    • Configuration
    • Status
  – Summary
  – Where to find additional information
Overview of NETCONF

- NETCONF is an IETF network management protocol designed to manage configuration:
  - Distinction between configuration and state data
  - Multiple configuration data stores:
    - Candidate, running, startup
  - Configuration change validations
  - Configuration change transactions
  - Selective data retrieval with filtering
  - Extensible Remote Procedure Call (RPC) mechanism
Overview of YANG

• YANG is a data modeling language for NETCONF:
  – Human readable, and easy to learn representation
  – Hierarchical configuration data models
  – Reusable types and groupings (structured types)
  – Extensibility through augmentation mechanisms
  – Supports definition of operations (RPCs)
  – Formal constraints for configuration validation
  – Data modularity through modules and sub-modules
  – Well defined versioning rules
Why Not SNMP for Configuration?

<table>
<thead>
<tr>
<th>Feature</th>
<th>Drawback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stateless, connectionless, single attribute get and set</td>
<td>Not practical for complex, multi-device configuration changes</td>
</tr>
<tr>
<td>No difference between configuration and state data</td>
<td>No support for backup and restore</td>
</tr>
<tr>
<td>Data-centric (table-driven) view of the world</td>
<td>Semantic mismatch with task-oriented world of configuration</td>
</tr>
</tbody>
</table>

NETCONF specifically **not** meant to **replace** SNMP in general but to **significantly improve** in the area of configuration management
Management Framework

- **Telecommunications Management Network (TMN) Management Functions**
  - Fault Management
  - Configuration Management
  - Accounting Management
  - Performance Management
  - Security Management

- **Trouble Ticket System**
  - Alarms, Events and Faults

- **Managing System**

- **Network Management System (NMS)**
  - YANG over NETCONF over SSHv2

- **Network Device (e.g., NID)**
  - Create/Read/Update/Delete Managed Objects

- **NETCONF 4-Layer Model**
  - YANG XML Schema
  - Content
  - Operations
  - Remote Procedure Call
  - Transport Protocol

- **Service OAM**
  - ITU-T Y.1731  End-to-End Performance Monitoring

- **IEEE 802.1ag  End-to-End Connectivity Fault Management**
SOAM CFM YANG Module Overview

• Connectivity Fault Management module describes IEEE 802.1Q and 802.1ap by implementing the objects and functions
  – Provides all managed objects which are defined in the corresponding SNMP MIB Modules:
    • IEEE8021-CFM-MIB
    • IEEE8021-CFM-V2-MIB
    • IEEE8021-TC-MIB

• Provides top level structure of Ethernet CFM
  – MD, MA, MEP
SOAM FM YANG Module Overview

- Fault Management module describes SOAM FM (MEF 30) by implementing the objects and functions
  - Provides all managed objects which are defined in the corresponding SNMP MIB Modules (MEF 31):
    - MEF-SOAM-FM-MIB
    - MEF-SOAM-TC-MIB
  - Provides extensions to IEEE
    - CC, LB, LT, AIS, LCK, Test
YANG Module Details
mef-cfm.yang Module Details

• The next several slides highlight the data model hierarchy of the mef-cfg.yang module.
• Refer to the specification for node descriptions
• Container: default-md-levels
  – Leaf: md-level
  – Leaf: mhf-creation
  – Leaf: default-id-permission
  – List: default-md-level
    • Leaf: primary-vid (key)
    • Leaf: component-id (key)
    • Leaflist: vid
    • Leaf: status
    • Leaf: md-level
    • Leaf: mhf-creation
    • Leaf: default-id-permission
mef-cfm.yang Module Details

• List: configuration-error-list
  – Leaf: vlan-identifier (key)
  – Leaf: interface (key)
  – Leaf: error-conditions

• List: maintenance-domain
  – Leaf: id (key)
  – Leaf: name-type
  – Leaf: name
  – Leaf: md-level
  – Leaf: mhf-creation
  – Leaf: id-permission
mef-cfm.yang Module Details

- List: maintenance-association
  - Leaf: id (key)
  - Leaf: name-type
  - Leaf: name
  - List: component-list
    - Leaf: component-id (key)
    - Leaflist: vid
    - Leaf: mhf-creation
    - Leaf: id-permission
  - Leaf: ccm-interval
  - Leaflist: remote-meps
  - List: maintenance-association-end-point
    - Leaf: mep-identifier (key)
mef-cfm.yang Module Details

- Leaf: interface
- Leaf: direction
- Leaf: primary-vid
- Leaf: administrative-state
- Leaf: mac-address
- Leaf: ccm-ltm-priority
- Container: continuity-check
  » Leaf: cci-enabled
  » Leaf: fng-state
  » Leaf: lowest-fault-priority-defect
  » Leaf: highest-priority-defect-found
  » Leaf: fng-alarm-time
  » Leaf: fng-reset-time
  » Leaf: active-defects
mef-cfm.yang Module Details

» Leaf: last-error-ccm
» Leaf: last-cross-connect-ccm
» Leaf: ccm-sequence-error-count
» Leaf: sent-ccms
  – Container: loopback
    » Leaf: replies-received
    » Leaf: replies-transmitted
    » Leaf: out-of-order-replies-received
    » Leaf: bad-msdu
  – Container: linktrace
    » Leaf: unexpected-replies-received
    » Container: linktrace-database
      • List: linktrace
        • Leaf: transaction-id (key)
mef-cfm.yang Module Details

- Container: target-address
  - Choice: address-type
    - Leaf: mac-address
    - Leaf: mep-id
  - Leaf: transmit-ltm-flags
- Leaf: default-ttl
- List: reply
  - Leaf: reply-order (key)
  - Leaf: reply-ttl
  - Leaf: forwarded
  - Leaf: terminal-mep
  - Leaf: last-egress-identifier
  - Leaf: next-egress-identifier
  - Leaf: ltr-relay
mef-cfm.yang Module Details

• Choice: chassis-id-subtype
  • Leaf: chassis-component
  • Leaf: interface-alias
  • Leaf: port-component
  • Leaf: mac-address-type
  • Leaf: network-address
  • Leaf: interface-name
  • Leaf: local
• Container: management-address
  • Choice: management-address
    • <series of case statements>
  • Leaf: ingress-action
  • Leaf: ingress-mac
  • Container: ingress-port-id
mef-cfm.yang Module Details

- Choice: port-id-subtype
  - Leaf: interface-alias
  - Leaf: port-component
  - Leaf: mac-address
  - Leaf: network-address
  - Leaf: interface-name
  - Leaf: agent-circuit-id
  - Leaf: local
  - Leaf: egress-action
  - Leaf: egress-mac
  - Container: egress-port-id
    - Choice: port-id-subtype (see above)
    - Leaf: organization-specific-tlv
mef-cfm.yang Module Details

- Container: remote-mep-database
  » List: remote-mep
    • Leaf: remote-mep-id (key)
    • Leaf: remote-mep-state
    • Leaf: failed-ok-time
    • Leaf: mac-address
    • Leaf: rdi
    • Leaf: port-status-tlv
    • Leaf: interface-status-tlv
    • Choice: chassis-id-subtype (see above)
mef-cfm.yang Module Details

• RPC: transmit-loopback
  – Inputs: mep-id, target-address, number-of-messages, data-tlv, vlan-priority, vlan-drop-eligible
  – Outputs: none

• RPC: abort-loopback
  – Inputs: mep-id
  – Outputs: none

• RPC: transmit-linktrace
  – Inputs: mep-id, target-address, transmit-ltm-flags, default-ttl
  – Outputs: transaction-id
mef-cfm.yang Module Details

• Notification identifier: fault-alarm
  – Container: alarm
    • Leaf: mep-id
    • Leaf: active-defects
Summary MEF 38

• MEF 38 defines the managed objects specified with the YANG data modeling language for using the NETCONF network management interface for the MEF 30 Service OAM Fault Management protocol

• MEF 38 enables MEF equipment providers to provide a standardized XML-based new generation management interface for the SOAM Fault Management functions:
  – Continuity Check/Remote Defect Indication
  – Loopback
  – Linktrace
  – Alarm Indication Signal
  – Lock Signal
  – Test Signal
Related Specifications

- MEF 30 SOAM FM
- MEF 31 SOAM FM MIB
- IEEE 802.1Q
- ITU-T Y.1731
- MEF 17 SOAM Requirements & Framework - Phase 1
- MEF 12.1 CE Network Architecture Framework Part 2: ETH Service Layer – Base Elements
- IETF RFC 6241 (NETCONF) & RFC 6020 (YANG)
Final Word

• **Service OAM**
  – In the context of MEF 38, data models (YANG Modules) are defined that support *service-level* OAM in MENs

• **Next Actions (For Further Information)**
  – Read the full MEF 30 Fault Management Implementation Agreement specification
  – Read the full MEF 38 specification (note, review of MEF 17, MEF 7.1, MEF 31 and MEF 15 may also be helpful)
  – Understand the principal service OAM components and capabilities
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 YANG 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
Accelerating Worldwide Adoption of
Carrier-class Ethernet Networks and Services

www.MetroEthernetForum.org