

MEF

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**

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 See MEF web site for official current list, minor updates and superseded work (such as MEF 1 and MEF 5)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 36	Service OAM SNMP MIB for Performance Monitoring
MEF 37	Abstract Test Suite for ENNI
MEF 38	Service OAM Fault Management YANG Modules Technical Specification
MEF 39	Service OAM Performance Monitoring YANG Modules Technical Specifications

MEF 38 Specification Overview

MEF 38 Service OAM Fault Management YANG Modules Technical Spec	
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 Specification Overview

MEF 38 - Service OAM Fault Management YANG Modules Technical Specification

Purpose

Specifies the Fault Management (FM) YANG Modules necessary to implement Service Operations, Administration, and Maintenance (OAM) that satisfies the Service OAM requirements and framework specified by MEF 17, MEF 30, the management objects specified in MEF 7.1, MEF 31, and the FM functions defined in IEEE 802.1Q and ITU-T Y.1731.

Audience

Applicable to entire Metro Ethernet Market including Service Providers, Access Providers, equipment vendors, and EMS/NMS/OSS vendors to provision and monitor equipment that is MEF compatible.

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

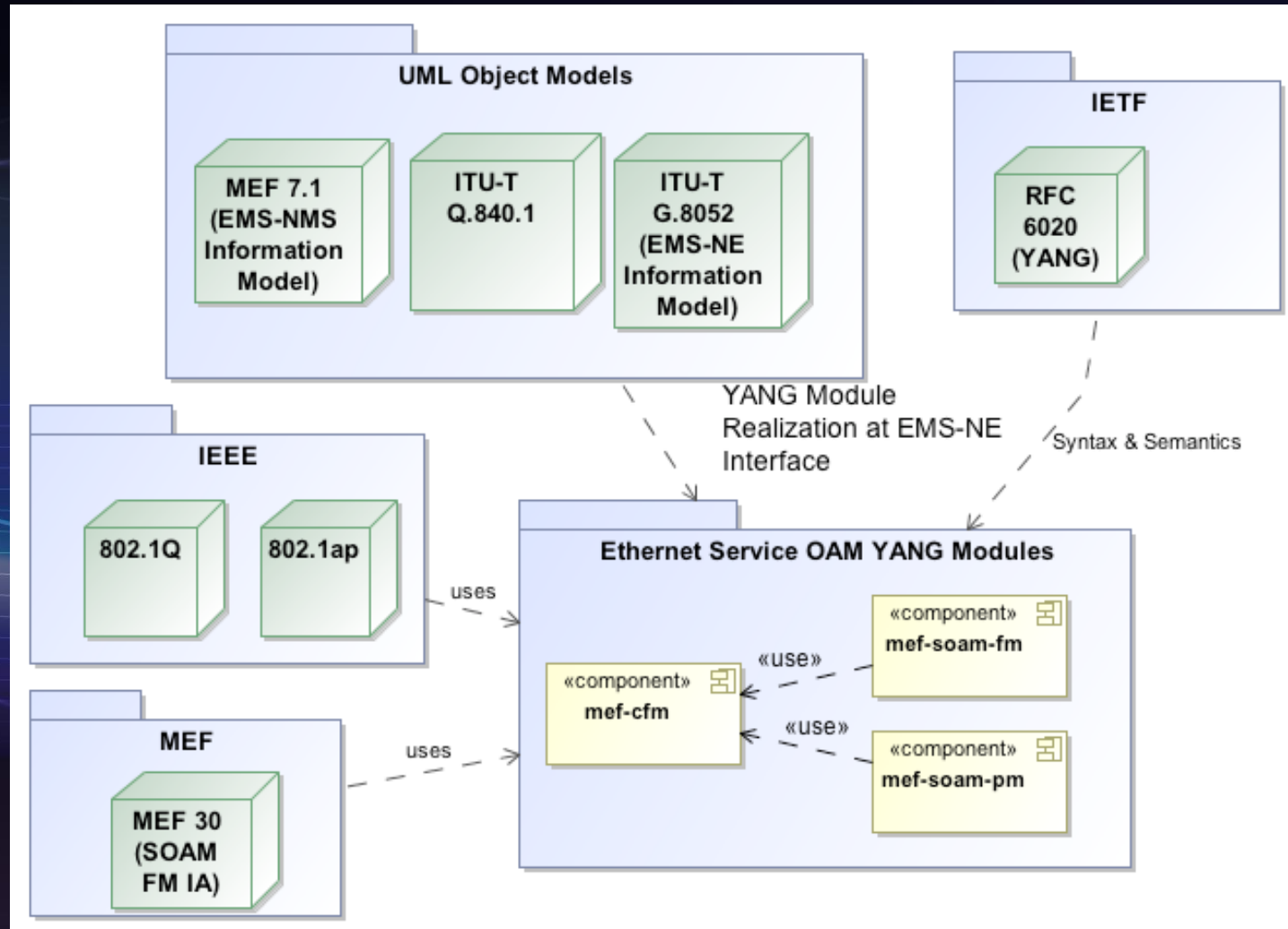
- MEF 38 requirements are primarily driven by MEF 30 and leverage the OAM functions & managed objects defined by MEF 31, IEEE 802.1Q and ITU-T Y.1731
- Managed objects to perform Fault Management functions such as Continuity Check, Loopback and Link Trace are covered in this Technical Specification
- SOAM Performance Management capabilities are covered in MEF 39

Terminology and Concepts

- **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)

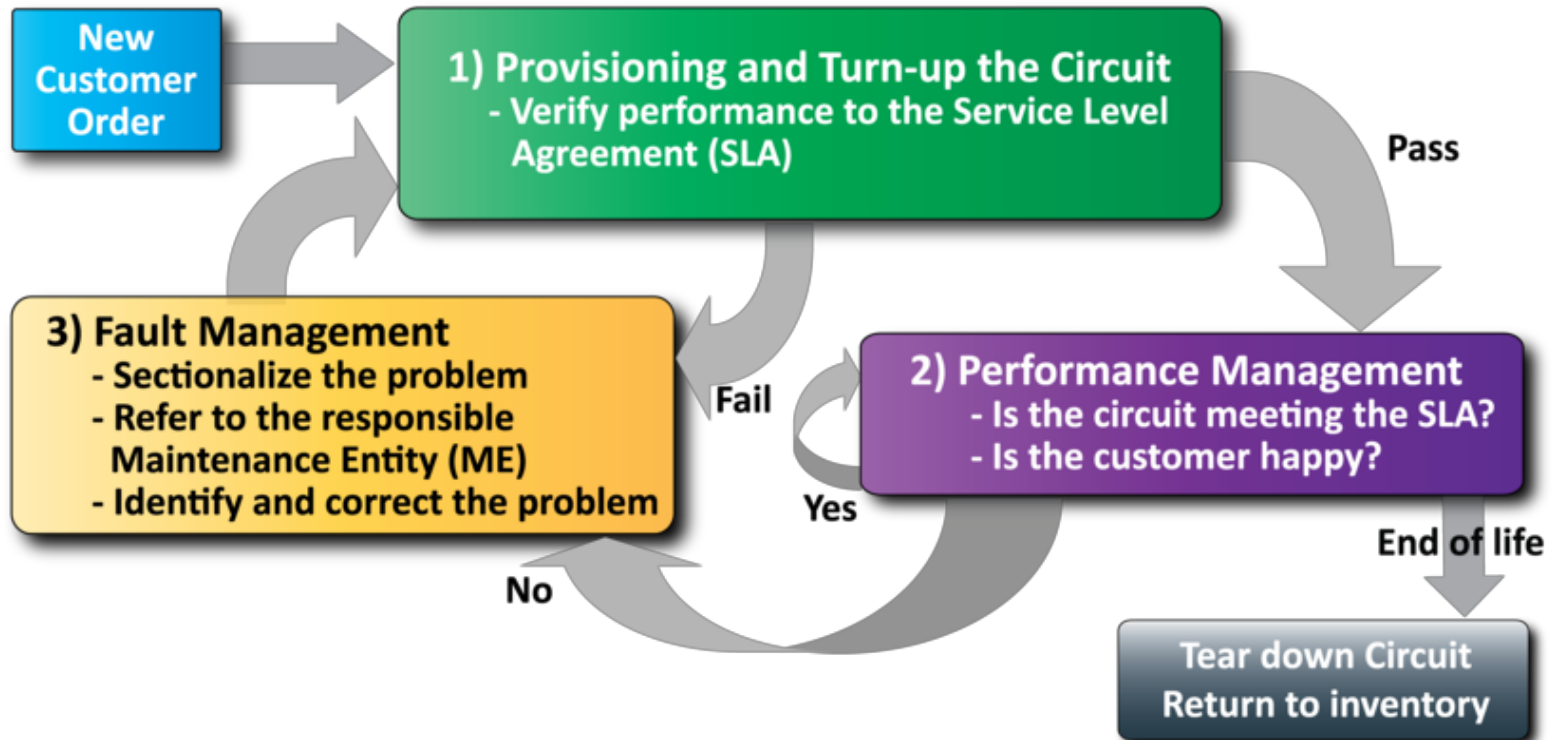
MEF-30 aligns with terminology found in ITU Y.1731

Relationship with other Specifications



MEF Service Lifecycle and SOAM

Network Management



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

MEF Specification Section Review

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

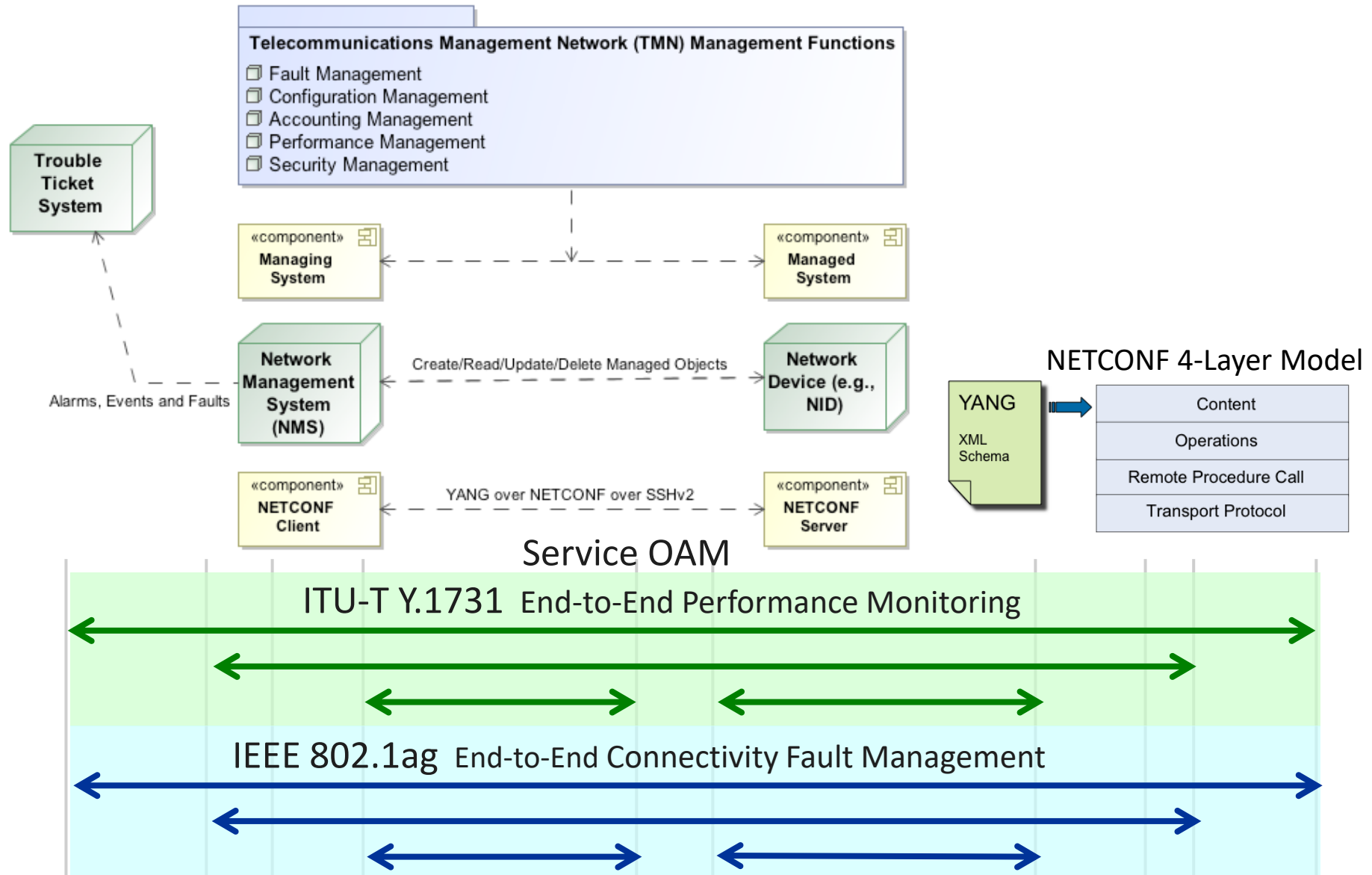
- **YANG is a data modeling language for NETCONF:**
 - Human readable, and easy to learn representation
 - Hierarchical configuration data models
 - Reusable types and groupings (structured types)
 - Extensibility through augmentation mechanisms
 - Supports definition of operations (RPCs)
 - Formal constraints for configuration validation
 - Data modularity through modules and sub-modules
 - Well defined versioning rules

Why Not SNMP for Configuration?

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

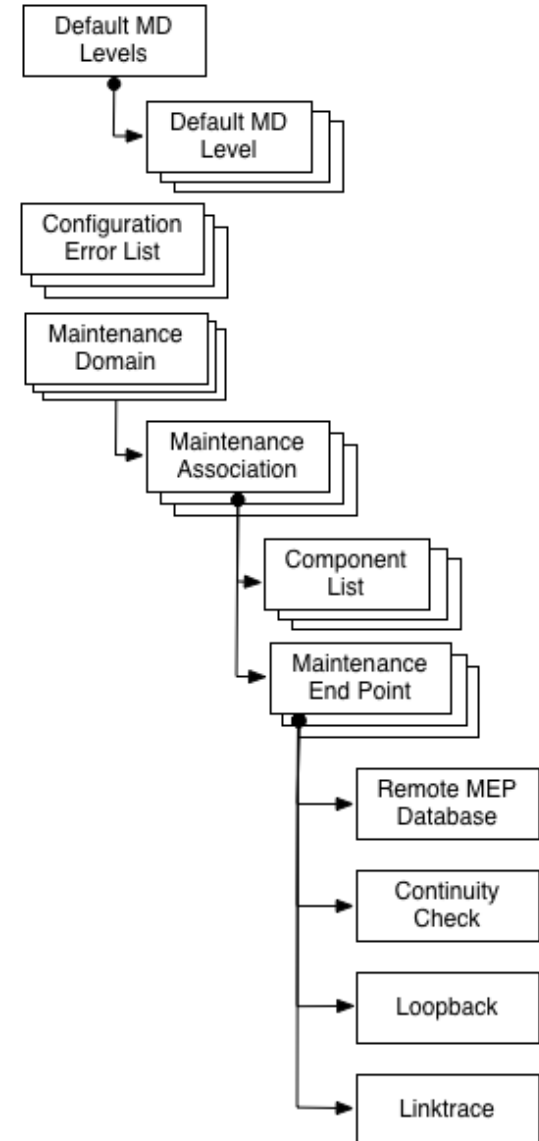
NETCONF specifically not meant to **replace** SNMP in general but to **significantly improve** in the area of configuration management

Management Framework



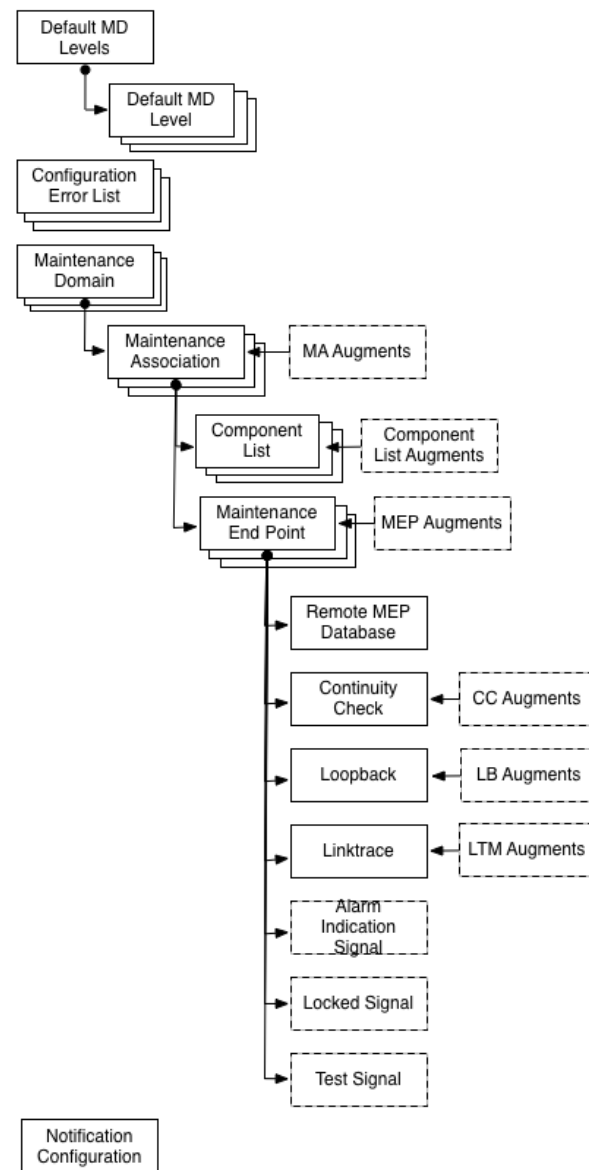
SOAM CFM YANG Module Overview

- **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

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

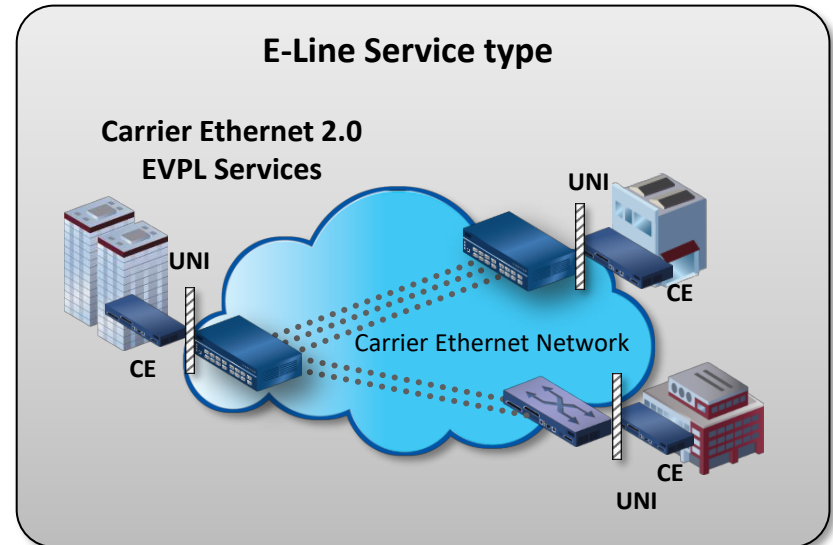
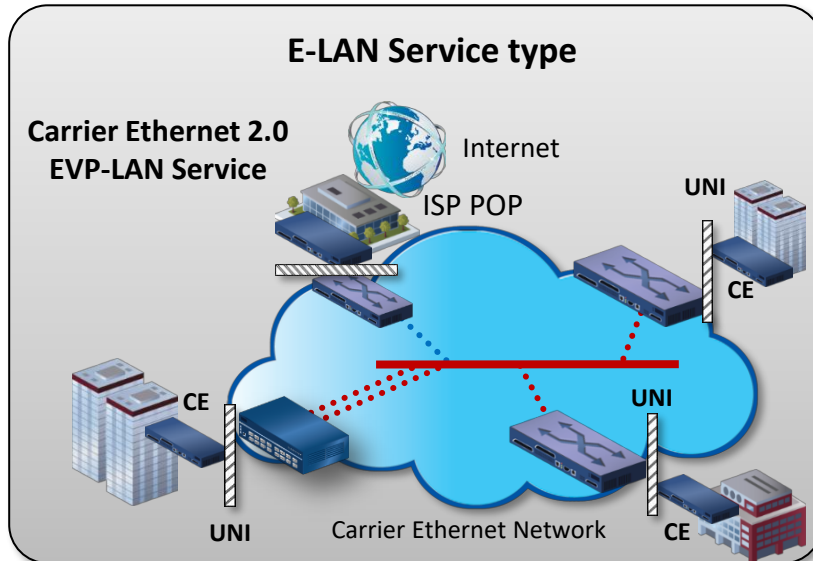
For Full Details ...

Please visit

www.metroethernetforum.org

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

MEF

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

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