MEF

Introducing the Specifications of the MEF

MEF 31: Service OAM Fault Management Definition of Managed Objects

July 2012

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**

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 See MEF web site for official current list, minor updates and superseded work (such as MEF 1 and MEF 5)

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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

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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

*Current at time of publication. See MEF web site for official current list, minor updates (such as MEF 31.0.1 amendment to this document) and superseded work (such as MEF 1 and MEF 5)

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MEF Specification Overview

MEF 31 - Service OAM (SOAM) Fault Management Definition of Managed Objects	
Purpose	Specifies the Fault Management (FM) Management Information Base (MIB) 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, and the FM functions defined in IEEE 802.1ag 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.

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Overview of MEF 31

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About MEF 31

- **Purpose:**
  - This presentation is an introduction to MEF 31 - Service OAM Fault Management Definition of Managed Objects

- **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
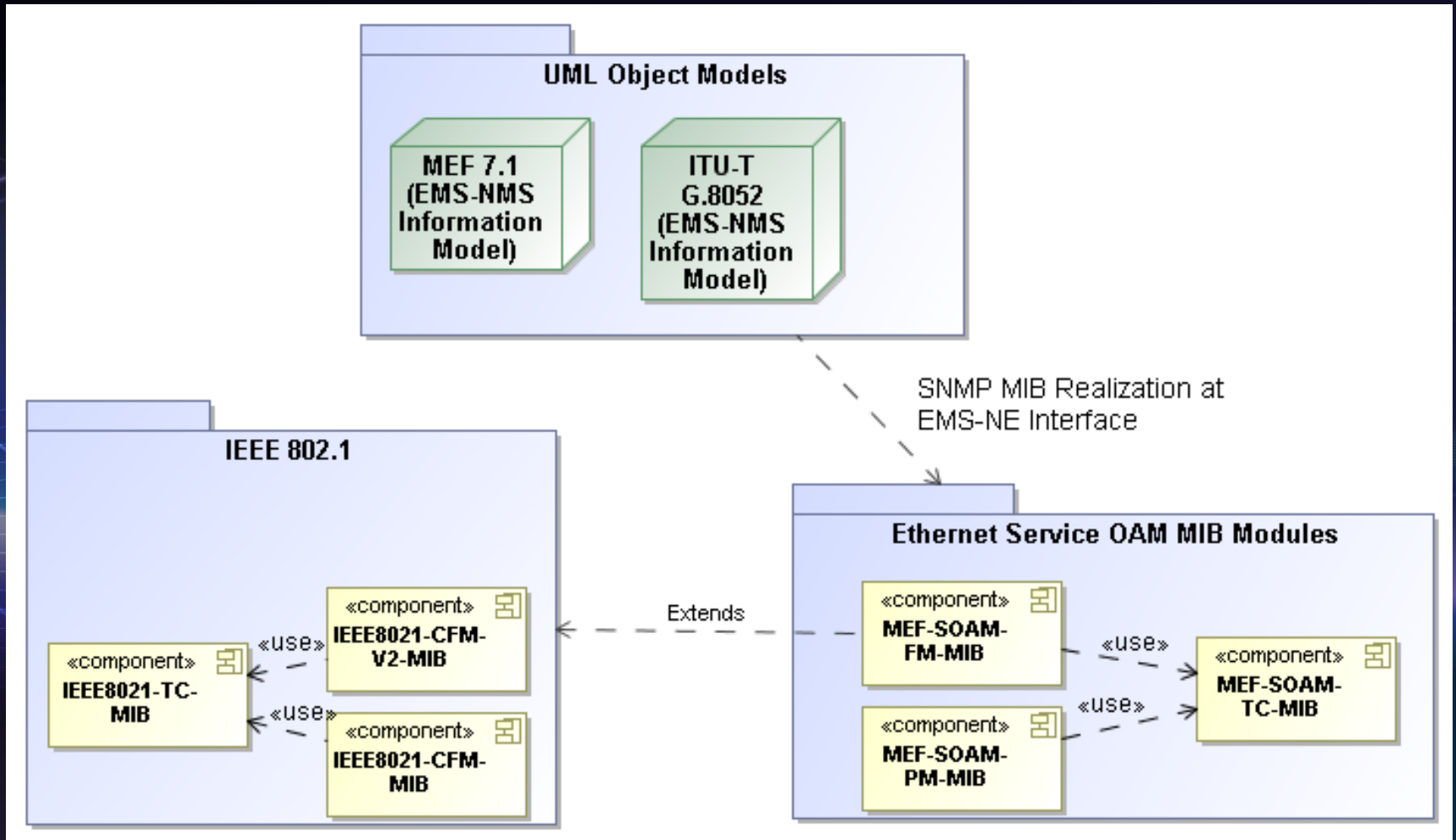
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MEF 31 - In Scope/Out of Scope

- **MEF 31 requirements are primarily driven by MEF 30 and leverage the OAM functions & managed objects defined by IEEE 802.1ag/ap 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 will be covered in future a MEF document**

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Terminology and Concepts

- **MEF 31 adheres to MEF 30 terminology:**
  - Refer to MEF 30 for ME, MEG, MEP, MIP, CoS
  - Continuity Check Message (CCM)
  - Alarm Indication Signal (AIS)
  - Remote Defect Indication (RDI)
- **MEF 31 introduces protocol specific terminology**
  - Simple Network Management Protocol (SNMP)
  - SNMP Manager
  - Management Information Model (MIB)
  - Element Management System (EMS)
  - Network Management System (NMS)
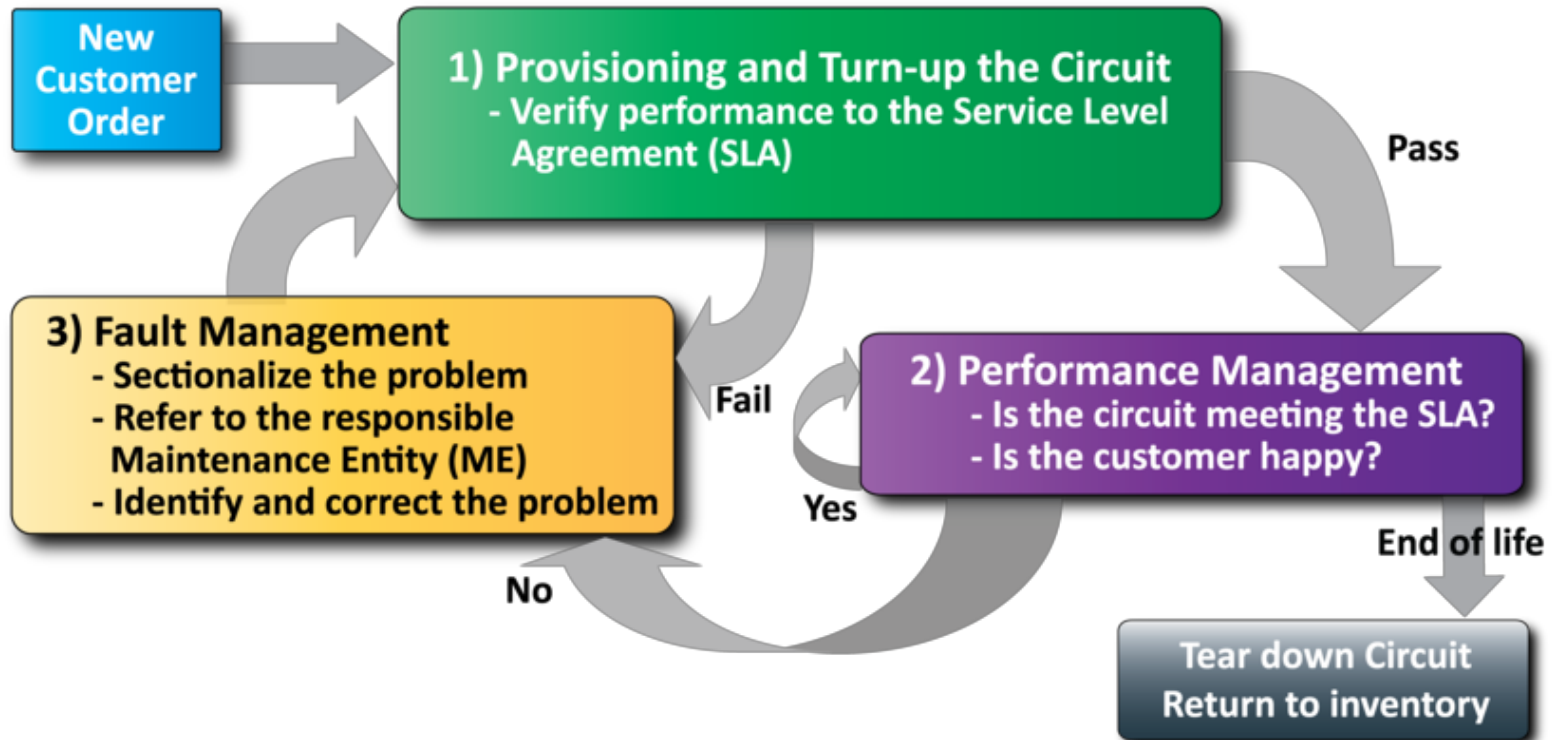 - Operations Support System (OSS)

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

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MEF Service Lifecycle and SOAM

Network Management

New Customer Order

1) Provisioning and Turn-up the Circuit
- Verify performance to the Service Level Agreement (SLA)

Pass

3) Fault Management
- Sectionalize the problem
- Refer to the responsible Maintenance Entity (ME)
- Identify and correct the problem

Fail

2) Performance Management
- Is the circuit meeting the SLA?
- Is the customer happy?

Yes

No

End of life

Tear down Circuit Return to inventory

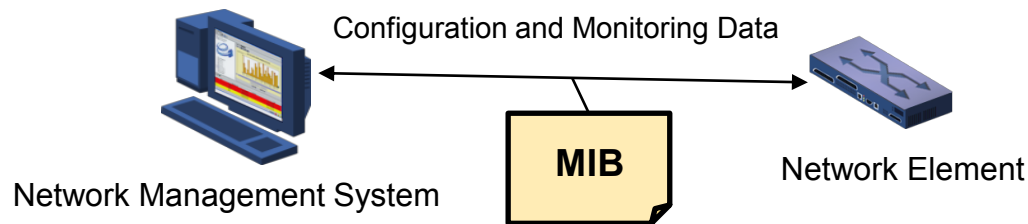**Fault management is a critical part of a circuit's lifecycle**

MEF Specification Section Review
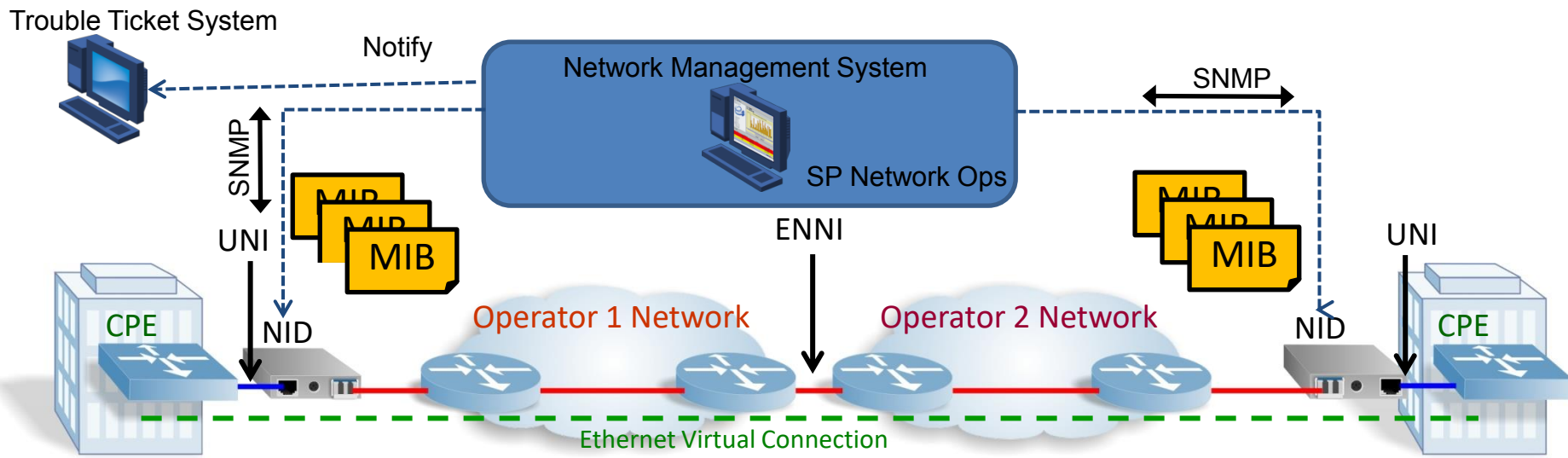
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Introducing MEF 31

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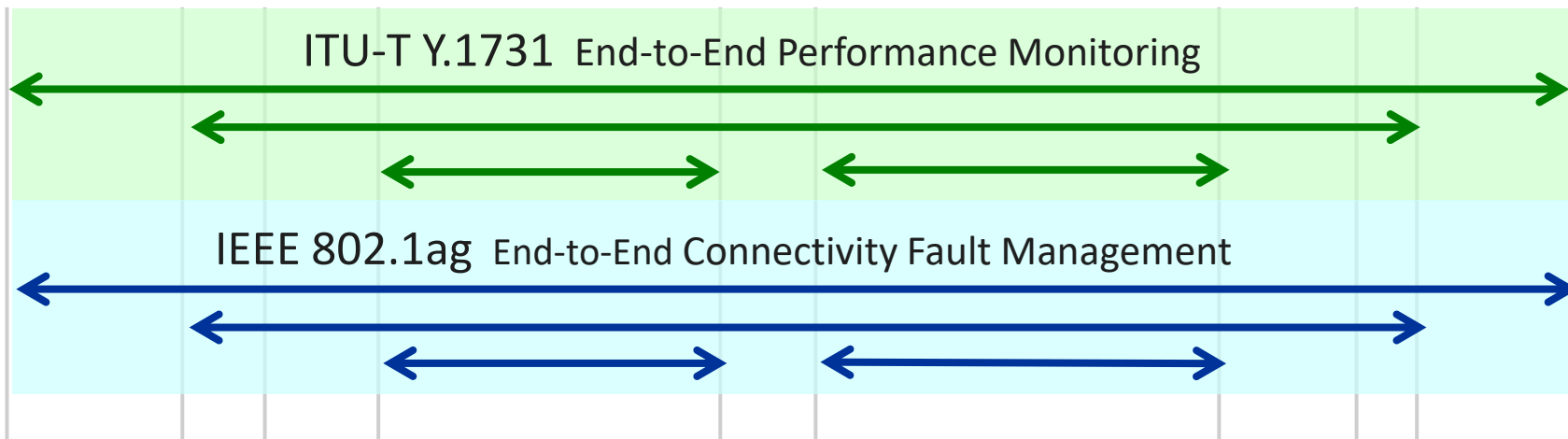 - Where to find additional information

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What is a MIB?

- A Management Information Base (MIB), or data model, is a collection of managed objects that can be used to provision or query a network device from a management system, such as a centrally located NMS (Network Management System).

- A MIB along with the management protocol, such as SNMPv2c, defines a standard network management interface for administration and maintenance of network elements.

Configuration and Monitoring Data

MIB

Network Management System

Network Element

Management Framework

Trouble Ticket System

Notify

Network Management System

SNMP

SP Network Ops

SNMP

UNI

MIB
MIB
MIB

ENNI

MIB
MIB
MIB

UNI

CPE

NID

Operator 1 Network

Operator 2 Network

NID

CPE

Ethernet Virtual Connection

Service OAM

ITU-T Y.1731 End-to-End Performance Monitoring

IEEE 802.1ag End-to-End Connectivity Fault Management

SOAM FM MIB Components

- **MEF 31 builds upon the Connectivity Fault Management (CFM) MIBs specified in IEEE 802.1ag and IEEE 802.1ap**
- **The IEEE CFM MIB set includes**
  - IEEE8021-CFM-MIB
  - IEEE8021-CFM-V2-MIB
  - IEEE8021-TC-MIB
- **MEF 31 extends the CFM MIB set as follows**
  - MEF-SOAM-TC-MIB
  - MEF-SOAM-FM-MIB

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SOAM TC MIB Overview

- **MEF-SOAM-TC-MIB defines a collection of Textual Conventions (common data types)**
  - ConnectivityStatusType
  - DataPatternType
  - IntervalTypeAisLck
  - MegIdType
  - OperationTimeType
  - TestPatternType

SOAM FM MIB Overview

- **MEF-SOAM-FM-MIB defines the managed objects necessary to support SOAM FM functionality:**

- Continuity Check (CCM)
- Remote Defect Indication Signal (RDI)
- Alarm Indication Signal (AIS)

- Linktrace
- Loopback
- Locked Signal
- Test Signal

- **Before SOAM operations are instantiated by a NMS application, the following must be provisioned at each Network Element (NE) performing OAM Functions:**
  - Maintenance Domain (MD)
    - Create entry in dot1agCfmMdTable
  - Maintenance Association (MA)/Maintenance Entity Group (MEG)
    - Create entry in dot1agCfmMaNetTable, ieee8021CfmMaCompTable, mefSoamNetCfgTable and mefSoamMegCfgTable
  - MEG End Point (MEP)
    - Create entry in dot1agCfmMepTable

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Continuity Check Configuration Entries

- **These 2 tables configure the Continuity Check OAM function with the associated parameters**

dot1agCfmMepTable	Object Description
CciEnabled	CCM Enabled Flag
CcmLtmPriority	CCM Priority
LowPrDefect	Lowest Priority Defect
FngAlarmTime	Fault Alarm Time
FngResetTime	Fault Alarm Reset Time

mefSoamCcCfgTable	Object Description
DropEligible	Drop Eligibility flag

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Continuity Check Status/Result Entries

- **These 2 tables provide the status and results of the Continuity Check OAM function**

dot1agCfmMepTable	Object Description
FngState	Current State of MEP FNG
HighestPrDefect	Highest Priority Defect
Defects	Active Defects
ErrorCcmLastFailure	Last-received CCM to trigger DefErrorCCM fault
XconCcmLastFailure	Last-received CCM to trigger DefXconCCM fault
CcmSequenceErrors	Total # out-of-sequence CCMs received
CciSentCcms	Total # CCMs sent

mefSoamMepFmStatsTable	Object Description
InOamFramesDiscarded**	Total # discarded OAM frames
StatsInCcmTotal	Total # valid received CCM frames

**Not directly related to the CCM OAM function but included here for Table completeness

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Loopback Configuration Entries

- **These 2 tables configure & invoke the Loopback OAM function with the associated parameters**

dot1agCfmMepTable	Object Description
TransmitLbmStatus	Status request
TransmitLbmDestMacAddress	Destination Mac address
TransmitLbmDestMepId	Destination MEP ID
TransmitLbmDestIsMepId	Destination MEP ID has been set (or not)
TransmitLbmMessages	# of Loopback messages to send (Trigger Mechanism)
TransmitLbmDataTlv	Data type length value
TransmitLbmVlanPriority	Vlan Priority
TransmitVlanDropEnable	Drop enable

mefSoamLbCfgTable	Object Description
MulticastEnabled	Multicast Enabled flag
Interval	Interval
FrameSize	Frame Size
DataPattern	Data Pattern
TestTlvIncluded	Test Type Length Value included
TestTlvPattern	Test Type Length Value Pattern
Timeout	Timeout

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Loopback Status/Results Entries

- **These tables provide the status and results of the loopback OAM function**

dot1agCfmMepTable	Object Description
LbrIn	# of Loopback responses received
LbrInOutOfOrder	# of Loopback responses received out of order
LbrBadMsdu	# of Loopback responses received w/bad MAC service data unit
LbrOut	# of Loopback replies transmitted
TransmitLbmResultOK	Results of the Loopback message operation

mefSoamLbStatsTable	Object Description
LbStatsNumLbrInCrc	Number of LBR messages with CRC errors

mefSoamLbrMulticastTable	Object Description
LbrMulticastTransId	Loopback Transaction ID
LbrMulticastReceiveOrder	An index to distinguish among multiple LBRs with the same Transaction ID
LbrMulticastReplyMac	Source MAC address returned of the LBR

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Alarm Indication Signal Configuration Entries

- **This table configures & invokes the Alarm Indication Signal (AIS) OAM function with the associated parameters**

mefSoamAisCfgTable	Object Description
Enabled	Specifies whether ETH-AIS transmission is enabled
Interval	Transmission period
Priority	Priority of frames with ETH-AIS information
MdLevel	The MEG/Maintenance Domain Level
DropEligible	Drop Eligibility flag

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AIS Status/Results Entries

- **This table provides the status and results of the Alarm Indication Status OAM function**

mefSoamAisStatsTable	Object Description
OutStatus	Current AIS transmission status
OutCounter	# of AIS messages sent
InStatus	Current AIS receive status
InCounter	# of AIS messages received
InMacAddr	The source MAC Address Field of last AIS received

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Linktrace Configuration Entries

- **This table configures & invokes the Linktrace OAM function with the associated parameters**

dot1agCfmMepTable	Object Description
CcmLtmPriority	LTM Priority value
TransmitLtmStatus	LTM Msg Transmission Locking Flag
TransmitLtmFlags	Flags Field (Trigger Mechanism)
TransmitLtmTargetMacAddress	Unicast Destination MAC Address
TransmitLtmTargetMepId	MEP ID Address
TransmitLtmTargetIsMepId	Target Address Indicator
TransmitLtmTtl	LTM TTL value
TransmitLtmEgressIdentifier	MEP Linktrace Initiator/Responder Identifier

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Linktrace Status/Results Entries

- **These tables provide the status and results of the loopback OAM function**

dot1agCfmMepTable	Object Description
LtmNextSeqNumber	Next Transaction Id to be sent
UnexpLtrIn	# of unexpected LTRs received
TransmitLtmResult	Indicates result of operation
TransmitLtmSeqNumber	Transaction Id of LTM Sent

mefSoamLtStatsTable	Object Description
LtmTransmitted	# of LTM messages sent
LtrReceived	# of LTR messages received
LtmReceived	# of LTM messages received
LtrTransmitted	# of LTR messages sent

Continued

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Linktrace Status/Results Entries (cont)

dot1agCfmLtrTable	Object Description
SeqNumber	Transaction Id of previous LTM
ReceiveOrder	Unique index for multiple LTRs for same LTM Transaction Id
Ttl	LTR TTL
Forwarded	Indicates if a LTM was forwarded by the responding MP
TerminalMep	Indicates if the LTM reached a MEP enclosing its MA
LastEgressIndentifier	Identifies the MEP Linktrace Initiator/Responder for the LTM to which this LTR is the response
NextEgressIdentifier	Identifies the Linktrace Responder that sent the LTR
Relay	Relay Action value
ChassisIdSubtype	The format of the Chassis ID returned in the Sender ID TLV of the LTR
ChassisId	Chassis ID returned in the Sender ID TLV of the LTR
ManAddressDomain	Tdomain that identifies type/format of the mgmt addr object used to access the SNMP agent of the system sending the LTR
ManAddress	Taddress (mgmt addr) for accessing the SNMP agent of the system sending the LTR

Continued ➡

Linktrace Status/Results Entries (cont)

dot1agCfmLtrTable	Object Description
Ingress	Value returned in Ingress Action Field of LTM
IngressMac	MAC Address returned in the ingress MAC Address field
IngressPortIdSubtype	Format of the Ingress Port ID
IngressPortId	Value of the Ingress Port ID
Egress	Value returned in the Egress Action Field of LTM
EgressMac	MAC Address returned in the Egress MAC Address field
EgressPortIdSubtype	Format of the Egress Port ID
EgressPortId	Value of the Egress Port ID
OrganizationSpecificTlv	All Organization specific TLVs returned in the LTR

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Locked Signal Configuration Entries

- **This table configures & invokes the Locked Signal OAM function with the associated parameters**

mefSoamLckCfgTable	Object Description
AdminState	Locking state (e.g., locked, unlocked)
Interval	Transmission period
Priority	Priority of frames with ETH-LCK information
MdLevel	The MEG/Maintenance Domain Level

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Locked Status/Results Entries

- **This table provides the status and results of the Locked Signal OAM function**

mefSoamLckStatsTable	Object Description
InStatus	Current LCK receive status
InCounter	# of LCK messages received
OutStatus	Current LCK transmission status
OutCounter	# of LCK messages transmitted

Remote Defect Indication Signal Configuration Entries

- **This 2 table configures the Remote Defect Indication (RDI) Signal OAM function with the associated parameters**

dot1agCfmMepTable	Object Description
CciEnabled	CCM Enabled Flag**

**RDI is a 1-bit information element carried in the Flags field of the CCM OAM PDU and is enabled through the CCM function.

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RDI Status/Results Entries

- **These tables provide the status and results of the Remote Defect Indication OAM function**

dot1agCfmMepDbTable	Object Description
RMepIdentifier	Remote MEP ID
Rdi	State of RDI bit in the last received CCM for the remote MEP identified by RMepIdenfier

mefSoamLtStatsTable	Object Description
RdiTransmitStatus	Indicates if local MEP is generating an RDI

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Test Signal Configuration Entries

- **This table configures & invokes the Test Signal OAM function with the associated parameters**

mefSoamTestCfgTable	Object Description
OutEnabled	Enables the ETH-Test transmit function
InEnabled	Enables the ETH-Test receive function
InService	Indicates in-service or out-of-service
DestMacAddress	Unicast Destination MAC Address
DestMepId	Destination MEP ID
DestIsMepId	Target Address Indicator
Interval	Transmission period
Priority	Priority of frames with ETH-TST information
DropEligible	Drop Eligibility flag
FrameSize	Frame Size

mefSoamTestCfgTable (cont)	Object Description
Pattern	Type of test pattern
StartTimeType	Type of scheduled start date/time to perform the on-demand ETH-Test operations
ScheduledStartDateAndTime	Scheduled start date/time to perform the on-demand ETH-Test operations
ScheduledStopDateAndTime	Scheduled stop date/time
RelativeStartTime	Specifies the relative start time, from the current system time, to perform on-demand ETH-Test
DurationTime	Duration of the ETH-Test operation
OutStatus	Flag indicator that another ETH-Test transmission operation is active

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Test Status/Results Entries

- **This table provides the status and results of the Test Signal OAM function**

mefSoamTestStatsTable	Object Description
NumIn	# of TST messages received
NumInOutOfOrder	# of out-of-order TST messages received
NumInCrcErrors	# of TST messages received with BER or data errors
NumInBerErrors	# of out-of-order TST messages received
NumOut	# of TST messages transmitted

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Alarm Configuration

- **These following objects provide alarm configuration for the 802.1ag CFM and MEF SNMP Notifications**

mefSoamFmNotificationCfg Group	Object Description
mefSoamAlarmInterval	A value indicating the shortest time interval in seconds between the generation of the same notification type per MEP to the list of notification destinations
mefSoamAlarmEnable	A vector of bits that indicates whether a specific notification is enabled

SNMP Notifications

- ## These following MEF SNMP Notifications provide for Autonomous alarms and events

SNMP Notifications (Traps)	Description
mefSoamMepDefectAlarm	This notification is sent when the value of dot1agCfmMepDefects changes
mefSoamConfigErrorAssertAlarm	This notification is sent when an entry is added to the ieee8021CfmConfigErrorListTable
mefSoamConfigErrorClearAlarm	This notification is sent when an entry is deleted from the ieee8021CfmConfigErrorListTable
efSoamMepOperStatusAlarm	This notification is sent when the value of mefSoamMepOperationalState changes
mefSoamLckAlarm	This notification is sent when the LCK PDU is received or when either mefSoamLckInStatus or mefSoamLckOutStatus changes
mefSoamAisAlarm	This notification is sent when the state of either mefSoamAisOutStatus or mefSoamAisInStatus changes

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Summary MEF 31

- MEF 31 defines the managed objects for using an SNMP management interface for the MEF 30 Service OAM Fault Management protocol
- MEF 31 enables MEF equipment providers to provide a standardized management interface for the SOAM Fault Management functions:
    - Continuity Check/Remote Defect Indication
    - Loopback
    - Linktrace
    - Alarm Indication Signal
    - Lock Signal
    - Test Signal

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Final Word

- **Service OAM**
  - In the context of MEF 31, data models (MIBs) are defined that support <u>service-level</u> OAM in MENs
- **Next Actions (For Further Information)**
  - Read the full MEF 30 Fault Management Implementation Agreement specification
  - Read the full MEF 31 specification (note, review of MEF 17, MEF 7.1 and MEF 15 may also be helpful)
  - Understand the principal service OAM components and capabilities

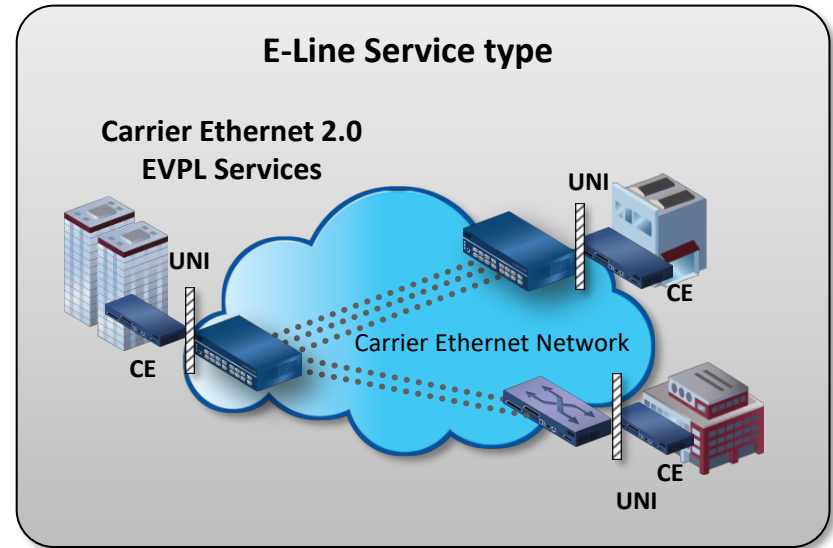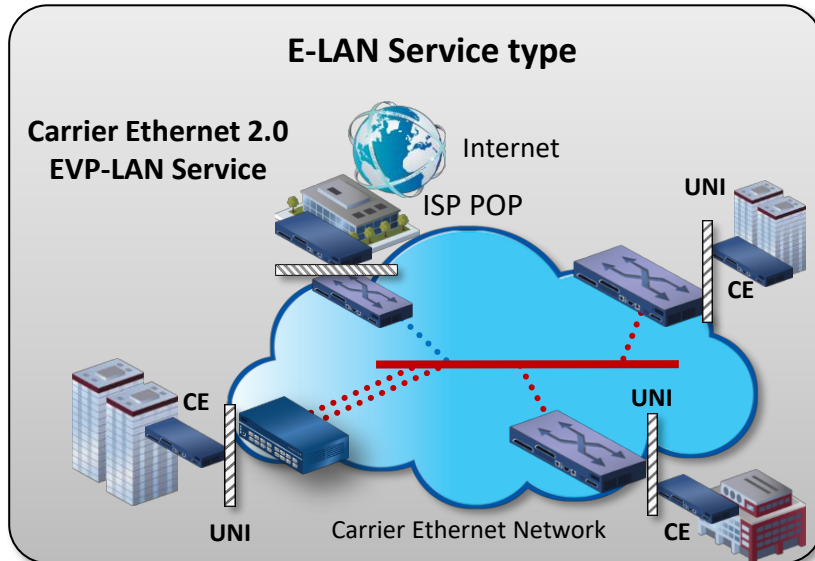**MEF**

For Full Details …

Please visit
www.metroethernetforum.org
Select Information Center on Left Navigation to access the full specification and extracted MIB files

E-LAN Service type

Carrier Ethernet 2.0 EVP-LAN Service

Internet
ISP POP
UNI
CE
UNI
CE
UNI
Carrier Ethernet Network

E-Line Service type

Carrier Ethernet 2.0 EVPL Services

UNI
UNI
CE
Carrier Ethernet Network
CE
CE
UNI

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

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