

IEEE P802.3ah EFM OAM Draft Development

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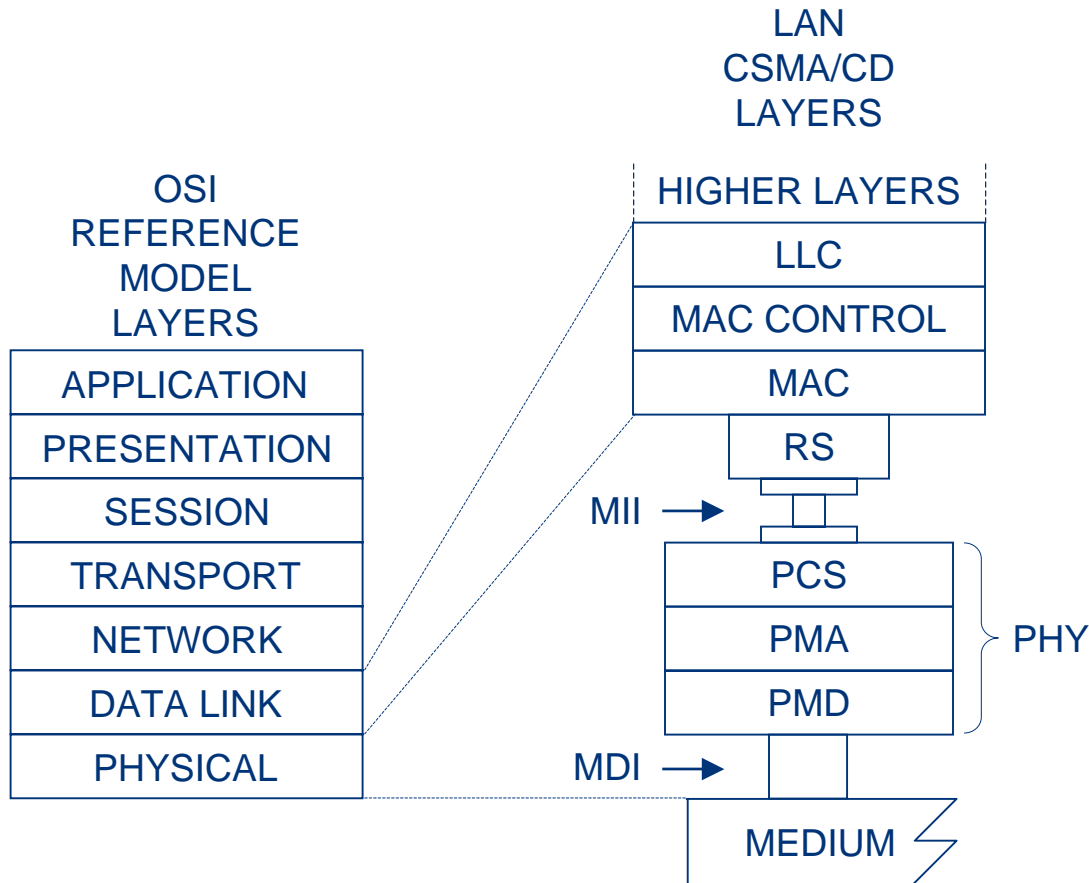
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Introduction

- **Initial attempt at developing the first MAC OAM draft**

OSI Layer Model



EFM OAM Objective

- **Support far-end OAM for subscriber access networks:**
 - **Remote Failure Indication**
 - **Remote Loopback**
 - **Link Monitoring**

High-level points

- **Key Points (based on gentry_1_0302.pdf)**
 - **Uses 128 byte Frames**
 - **Provides:**
 - **Asynchronous Autonomous Reporting of Events**
 - *Failure Indications*
 - **MAC Layer Ping and Loopback Control**
 - **Extensible Management Control Channel**
 - *Link Monitoring*
 - *Performance Monitoring*
 - *Clause 30 Attributes*
 - *Vendor Extension Mechanism*
 - **Both fixed interval reporting and query response supported**
 - **Provides hook(s) for authentication**

Approach

- *The following slides cover several elements of developing the OAM draft.*
- *The title lists the topic. The text then provides details and in many cases raises issues needing resolution.*
- *In general, **orange text** represents questions or relatively new ideas being introduced.*

OAM Frame Format

Suggested additions

MAC DA	MAC SA	Length/type	Sub type	Ver	Flags	Code	Data	FCS
6	6	2	1	1	1	1	106	4

Field	Description	Value
MAC DA	Slow_Protocols_Multicast Address	01-80-c2-00-00-02
MAC SA	Station's MAC Address	48-bit individual address of the station (egress port) sending the frame
Length/type	Slow_Protocols_Type	88-09
Subtype	Protocol Subtype	EFM OAM value (03 is next available)
Version	OAM Protocol Version	01
Flags	OAM Flags: RF, LF, etc	Remote/Local Fault, loopback, alarms, etc
Code	OAM Code	00=Null, 01=Ping Req, 02=Response, ...
Data	Up to 106 octets	Data/Pad
FCS	Frame Check Sequence	32-bit CRC

OAM Frame Format

- **Version:** signifies initial work by IEEE P802.3ah
- **Flags:** provides indication of remote/local fault, alarms
- **Code:** provides 256 opcodes
 - 128 allocated for OAM
 - 128 allocated for vendor extensions
- **Data:** provides payload for up to fifteen 32-bit counters or nine 64-bit counters

OAM Frame Generation

- **OAM Frames are generated by MAC Clients**
 - There is no restriction on how they are generated (hardware vs. software)
- **OAM Frames are sent across a single link**
 - P2P link (fiber or copper) or P2MP link
- **OAM Frames are BPDUs and are not forwarded or switched by 802.1D bridges**
- **Slow Protocols recommends 5 fps maximum transmission rate**
 - **Unanswered question: Would .x Flow Control block MAC OAM Frames?**

OAM Negotiation

- **Determines if remote device has OAM enabled or not**
 - **If far-end does not support OAM or is disabled, what happens?**
- **Ability to negotiation upon link bring-up and any other time**
- **Authentication attribute included**
- **Peer/Peer mode**
 - **OAM provides ability to send stats/ping in both directions**
 - **Upper layers provide capability to control certain OAM features/directions**
- **Vendor extension capability discovered**
 - **Identified with OUI**
- **Unidirectional capability discovered**
 - **Work Item**
 - **Follow-up on unidirectional limitations with current PHYs**
 - **Clause 37 zeroed /C/ ordered sets set when sync=false**
 - **Need state between sync=true and link_ok=true**
- **Requires state machine**
- **Enables optional PHY OAM capability**

OAM Unidirectional Operation

- **EFM PHYs should support unidirectional link operation**
 - **When unidirectional, only OAM information is sent – no user traffic is sent**
 - **EFM PHYs need an attribute defined whereby MAC client can determine unidirectional support**

OAM & SNMP

- **OAM supplements SNMP**
- **OAM provides means to retrieve/store remote stats**
- **New object class in Clause 30**
 - **oRemoteEntity**
 - **Must include provisions for 16+ ONUs**
- **SNMP can query remote stats after link/far-end device failure**
 - **Failure determined outside context of reading stats**

OAM & Authentication

- **OAM provides hooks for authentication**
- **OAM defines authenticationState attribute**
- **Prior to authentication, minimal stats provided to remote node**
- **After authentication, complete stats provided to remote node**
- **Authentication mechanism not defined by EFM**
 - **Could use 802.1x, etc**

OAM & MAC Layer Ping

- **OAM Code defined for Ping Request**
- **OAM Code defined for Ping Response**
- **Non-modal: normal traffic/other OAM Frames may be interspersed**
- **Connectivity test only**
 - **Not BERT**
 - **Not throughput test**

OAM & Attributes

- Clause 30 attributes sent as:
 - Type, Length (in octets), Value
 - Type from Annex 30A, start with tuple after csmacdmgmt.
- Full attribute of *Tx Frames*:
- {iso(1) member-body(2) us(840) 802dot3(10006) csmacdmgmt(30) attribute(7) framesTransmittedOK(2)};
- Encoded as:

8 bits	8 bits	8 bits	8-64 bits
0000 0111	0000 0010	0100 0000	<i>value</i>

attribute Tx Frames 64b

- Other attribute examples:
 - aFramesTransmittedOK attribute(7), framesTransmittedOK(2)
 - aFramesReceivedOK attribute(7), framesReceivedOK(5)
 - aFrameCheckSequenceErrors attribute(7), frameCheckSequenceErrors(6)
 - aOctetsTransmittedOK attribute(7), octetsTransmittedOK(8)
 - aOctetsReceivedOK attribute(7), octetsReceivedOK(14)

OAM & Attributes

- **Is 8-bits sufficient for first, second fields?**
- **Should an escape mechanism be included for attributes beyond 127?**
 - **0xxx xxxx = Attribute (0..127)**
 - **1000 0000 = Escape, go to next octet (add 128)**
 - **0xxx xxxx = Attribute (128...255)**
 - **1000 0001 = Escape, go to next octet (add 256)**
 - **0xxx xxxx = Attribute (256...383)**
 - **...**

OAM & Code Map

00	Local Capability
01	Remote Capability
02	Keep Alive
03	Event Notification
04	Loopback Control
05	<i>reserved</i>
06	Generate Ping
07	Echo Ping
08	Link Monitor Query
09	Link Monitor Response
0A	Attribute Query
0B	Attribute Response
0C-7F	<i>Reserved</i>
80-FF	<i>Vendor Specific</i>

OAM & Code=00

■ Local Capability

- Sent during Negotiation
- Negotiation protocol not yet determined
- Data field not yet determined
 - Send state information

OAM & Code=01

■ Remote Capability

- Sent during Negotiation
- Negotiation protocol not yet determined
- Data field not yet determined
 - Send state information

OAM & Code=02

■ Keep Alive

- Sent once per second
- Flags sent
- Data field not yet determined
 - Could be left zeroed?
- Non-receipt of Link Monitor frames means either:
 1. Far-end OAM disabled
 2. Far-end OAM fault
 3. Link down in at least ingress direction
 - 4.

OAM & Code=03

■ Event Notification

- Includes event details
 - Should stats also be sent to troubleshoot
 - *Maybe we define some subset that are included (frames lost, etc)*
- Specify response time?
- Events included:
 - Remote Fault
 - Local Fault
 - Power failure?
 - Temperature alarms?
 - Dying gasp?
 - Signal degrade?
 - Local/remote reset detected?
- How many are standard OAM events and how many are out of scope (vendor specific extensions)?
 - Link specific events (such as specific to copper)

OAM & Code=04

■ Loopback Control

- Enables/disables far-end frame-based loopback
- **Implied failsafe timeout included in OAM?**
 - **Is timeout agreed or learned upon initialization?**
 - When loopback enabled, start timer.
 - Exit loopback when either timer expires or when loopback disable command is received.
- Review past discussion about path of loopedback frames

OAM & Code=06

■ Generate Ping

- 106 octet data field not specified
- Data field intended to be copied verbatim in Echo Ping
- Sent any time
- Frequency up to 5 per second.
- Could be initiated by higher layer protocols.

OAM & Code=07

■ Echo Ping

- 106 octet data field copied from Generate Ping

OAM & Code=08

■ Link Monitor Query

- Request set of link/performance monitor attributes
 - Define subscriber access set from Clause 30?
 - Link/Performance monitor set #1:
 1. aFramesTransmittedOK
 2. aFramesReceivedOK
 3. aFrameCheckSequenceErrors
 4. aOctetsTransmittedOK
 5. aOctetsReceivedOK

OAM & Code=09

- **Link Monitor Response**
 - Return set of link/performance monitor attributes

OAM & Code=0A

■ Attribute Query

- Request set of attributes, in form of:
 - Type, Type, Type, ... Null
- No limit to number of attributes queried
- Multiple attribute response frames can result from single query
- Far-end could ignore queries if too many queries received

OAM & Code=0B

■ Attribute Response

- Return set of attributes, in form of
 - Type, Length, Value; Type, Length, Value; ... Null

OAM & Code=0C-7F

- Reserved for future use

OAM & Code=80-FF

- **Vendor Specific**
 - **Reserved for vendor extensions**