IEEE P802.3cg
OAM

David D. Brandt, Rockwell Automation

Purpose

- The purpose of this presentation is to:
  - Examine the utility of OAM for 10BASE-T1S

There are multiple OAMs

- 802.3-2015
  - 57. Operations, Administration, and Maintenance (OAM)
  - Hardware or software above MAC
  - PHY-independent
  - Supports ITU-T Y.1730
- 802.3bp-2016
  - 97.3.8 1000BASE-T1 Operations, Administration, and Maintenance (OAM)
  - “PCS OAM”

CLAUSE 57 GENERIC OAM

OAM functions (optional)

- Discovery, Remote failure indication, Remote loopback, Link events, Polling MIBs

- 57.1.1 Scope
  - "OAM provides network operators the ability to monitor the health of the network and quickly determine the location of failing links or fault conditions."

OAM sublayer

- Optional sublayer sits above and uses the MAC

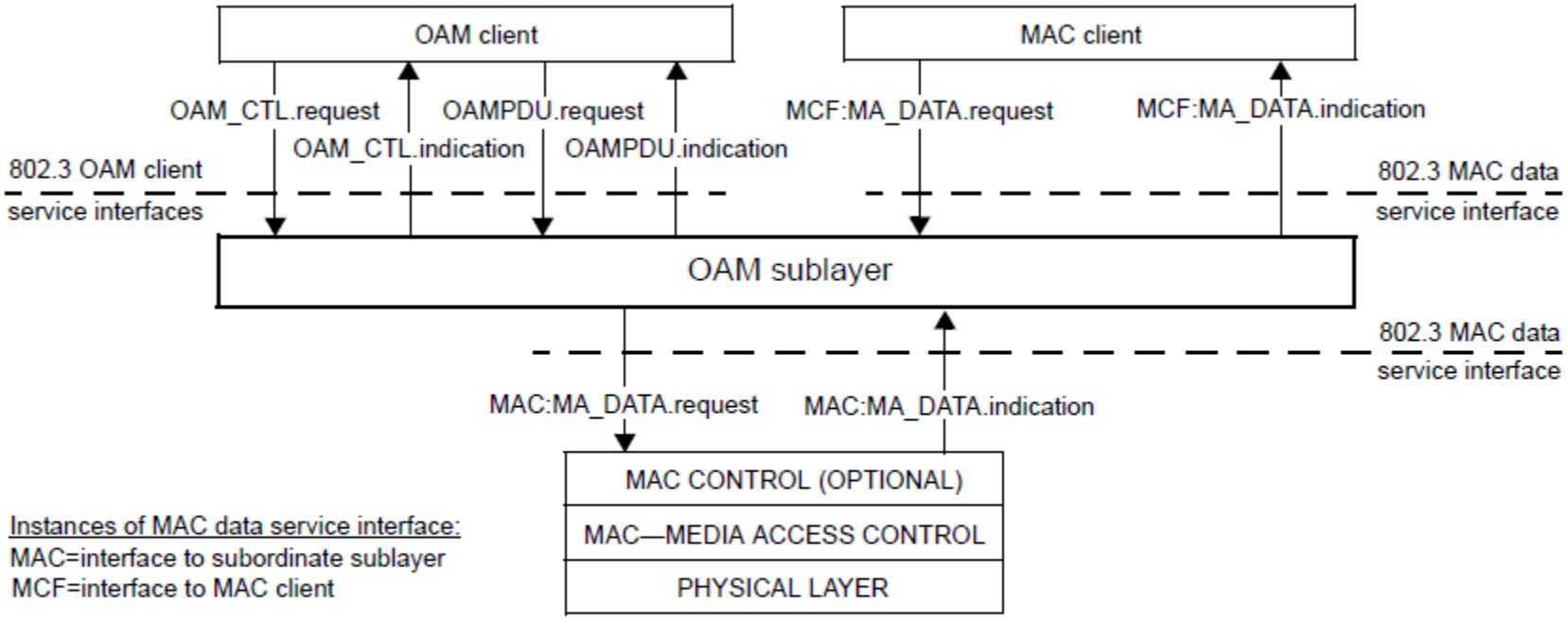

Figure 57–2—OAM sublayer support of interlayer service interfaces

OAMPDU frame

- Dedicated MAC ID
- Slow Protocol

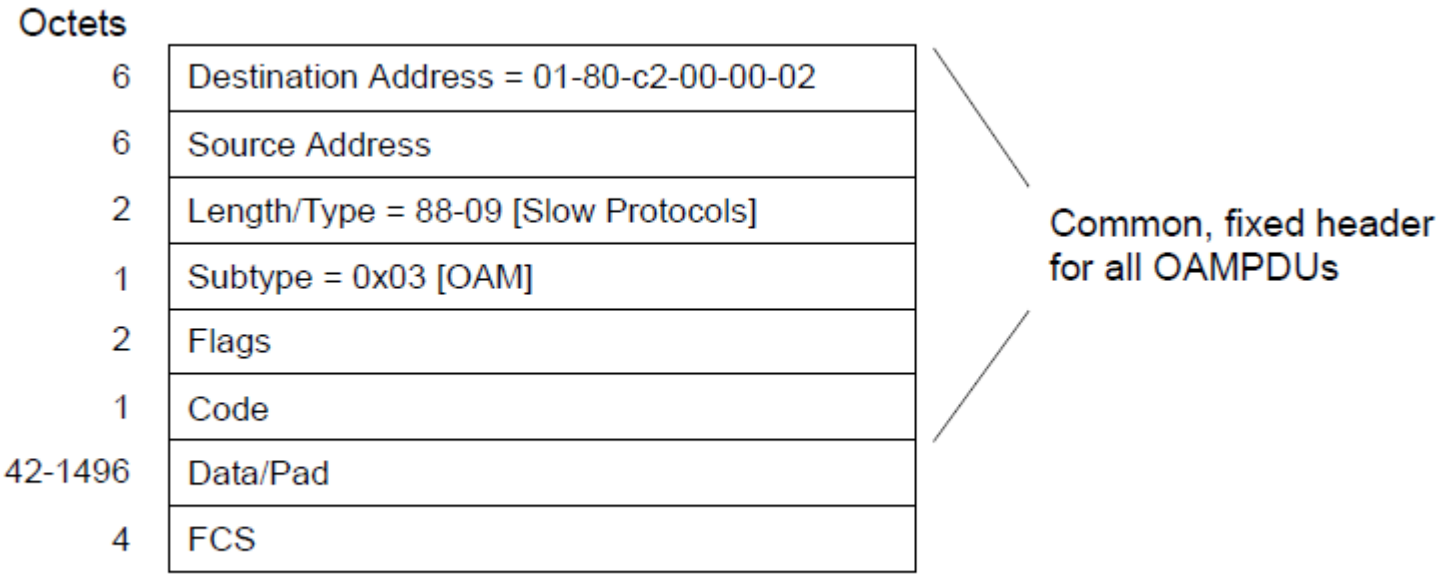

Figure 57–9—OAMPDU frame structure

Slow Protocols

57A.6.2.3 Transmission characteristics

Item	Feature	Subclause	Value/Comment	Status	Support
SP1	Transmission rate	57A.2	Max 10 frames in any one-second period	M	Yes [ ]
SP2	Data field	57A.2	No larger than maxBasicDataSize (see 4.2.7.1)	M	Yes [ ]

- maxBasicDataSize = 1500 octets
  - Recommendation is less than 128 octets
- Maximum number of Slow Protocol subtypes is 10

Maximum slow protocol bandwidth

- 57A.2 Slow Protocol transmission characteristics
  - 100 maximum length frames per second per point-to-point link
  - 100 maximum length frames per ONU for point-to-multipoint topologies
- Maximum per-node overhead 1.2 Mb/s
  - 1500 * 100 * 8 = 1200000
- Per-node overhead for OAM alone
  - 120 kb/s @ 1500 octets
  - 10 kb/s @ 128 octets

Maximum OAMPDU Size

- Size can be limited

Table 57–9—OAMPDU Configuration field

Bit(s)	Name	Description
15:11	*Reserved*	In Local Information TLVs, reserved bits shall be set to zero when sending an OAMPDU, and should be ignored on reception for compatibility with future use of reserved bits.
10:0	Maximum OAMPDU Size	11-bit field which represents the largest OAMPDU, in octets, supported by the DTE. This value is compared to the remote's Maximum OAMPDU Size and the smaller of the two is used. The minimum value of this field is minFrameSize / 8. The maximum value of this field is equal to maxBasicFrameSize, which is defined in 4.4.2. Prior to exchanging Maximum OAMPDU Size and agreeing upon a maximum OAMPDU size, a DTE sends OAMPDUs of length minFrameSize / 8. The OAMPDUs transmitted by a DTE are limited by both the local DTE's Maximum OAMPDU Size and the remote DTE's Maximum OAMPDU Size as indicated in received Information OAMPDUs. A DTE is not required to change the value transmitted in this field after negotiation to an agreed size as each end will dynamically determine the correct maximum OAMPDU size to use.

Point-point limitation

- 57.1.5 Compatibility considerations
  - "OAM is intended for point-to-point and emulated point-to-point IEEE 802.3 links."

- 10BASE-T1S supports multidrop without emulated point-to-point

“This is what we are talking about in 10BASE-T1S…”

CLAUSE 97 PCS OAM

OAM functions (optional)

- Ping
- Gross SNR
- Unspecified messages

	D8	D7	D6	D5	D4	D3	D2	D1	D0
Symbol 0	Even Parity	Reserved	Reserved	Reserved	Reserved	PingRx	PingTx	SNR<1>	SNR<0>
Symbol 1	Odd Parity	Valid	Toggle	Ack	TogAck	Message_Number<3:0>			
Symbol 2	Odd Parity	Message<0><7:0>							
Symbol 3	Odd Parity	Message<1><7:0>							
Symbol 4	Odd Parity	Message<2><7:0>							
Symbol 5	Odd Parity	Message<3><7:0>							
Symbol 6	Odd Parity	Message<4><7:0>							
Symbol 7	Odd Parity	Message<5><7:0>							
Symbol 8	Odd Parity	Message<6><7:0>							
Symbol 9	Odd Parity	Message<7><7:0>							
Symbol 10	Odd Parity	CRC16 first bit							
Symbol 11	Odd Parity	final bit CRC16							

Figure 97–15—OAM Frame

Ping

- Closed loop control monitors and responds appropriately to lost messages
  - Lost link
  - Failed nodes

SNR<1:0>

- 00: PHY link is failing and will drop link and relink within 2 ms to 4 ms after the end of the current 1000BASE-T1 OAM frame
- 01: LPI refresh is insufficient to maintain PHY SNR. Request link partner to exit LPI and send idles (used only when EEE is enabled)
- 10: PHY SNR is marginal
- 11: PHY SNR is good

- Expected to drive retrain, but function does not exist in 10BASE-T1S

Conclusions

- Derivative of Clause 97
  - No obvious value for 10BASE-T1S with realtime control
  - Potential for propagation of incompatible versions
- Clause 57
  - Supports maintenance of remote locations
  - Already works with 3cg in point-point mode
- Both
  - Neither supports multidrop
  - Neither adequately addresses link diagnostics or rapid link repair

Recommendation

- Remove PCS level OAM references from 3cg
- Further consider link diagnostics