10BASE-T1S OAM

Tim Baggett

IEEE 802.3cg Task Force – Ad Hoc – 20 June 2018

Outline

- Clause 57: OAM – A Brief Overview
- OAM on 1000BASE-T1
- 10BASE-T1S Preamble OAM Issues
- Other OAM use on 10BASE-T1S?
- Conclusion
- References

Clause 57: OAM
A (very) Brief Overview

- **Objectives**
  - Remote Failure Indication
    - e.g., non-operational receive path
  - Remote data link layer loopback
  - Link Monitoring
    - Inclusion of link diagnostic information
  - Clause 30 MIB variable polling (no writing/setting)
  - Optional OAM capability discovery
- **Traverse only a single link**
  - Not forwarded by MAC clients
  - No mention of use on mixing segments
    - OAM is intended for point-to-point links only (57.1.5.1)

Clause 57: OAM

- **OAMPDU – OAM Packet Data Units**
  - Encapsulated within standard Ethernet frames
  - Slow Protocols (Annex 57A)
  - Multicast address 01-80-C2-00-00-02
    - Does not target a specific PHY
  - EtherType 88-09
  - Slow Protocol Subtype 03

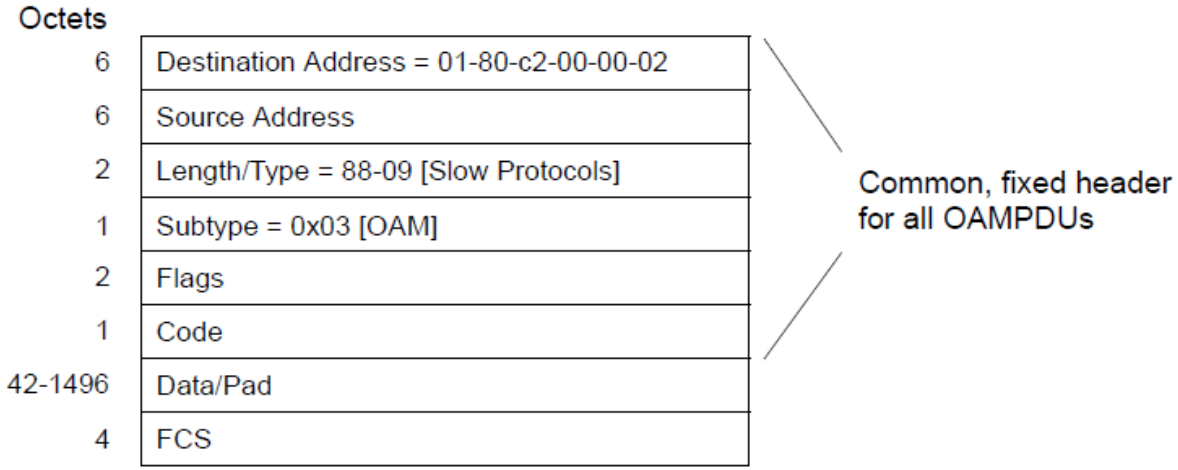

Figure 57–9—OAMPDU frame structure

OAM on 1000BASE-T1

- **Only point-to-point**
  - Peer PHY in communication is assumed
    - No need for addressing
    - Know which PHY is acknowledging
- **OAM sent in normal mode data frames**
  - 4050-bit, Reed Solomon FEC protected

OAM on 1000BASE-T1

- **Low Power Idle**
  - Periodic REFRESH is needed to retrain receive equalizer when no Ethernet frames are being transmitted
    - Creative use as a side-channel for OAM, outside normal Ethernet frames
    - OAM can be used to wake up the transmitter if the equalizer drifts too much reducing SNR

10BASE-T1S Preamble OAM Issues

- **Point-to-Point**
  - Only one other PHY, no addressing is needed
- **Multi-drop**
  - Ambiguous multi-drop PHY addressing
    - All PHY will receive the OAM
  - PHY acknowledgement ambiguity
    - Which PHY gets to acknowledge? Which PHY did acknowledge?
    - Acknowledgement is critical for MDIO register / PHY flow control
  - Arbitration is missing to prevent multiple simultaneous OAM transmissions from multiple senders
    - Phys receiving fragments from multiple transmitters.
  - Limited space in Preamble to support these

10BASE-T1S Preamble OAM Issues

- **OAM can block**
  - DME idle silence → inherently energy efficient
  - Will not transmit if there is no data to send
    - No receive equalizer to maintain with REFRESH
    - No side-channel as in 1000BASE-T1
  - OAM cannot be sent if there are no Ethernet frames to transmit

Other OAM use on 10BASE-T1S?

- **Wake-up?**
  - Receiver must be awake to receive a preamble OAM.
    - The transmitter will be powered down when not in use.
    - Wake-on-LAN (WoL) can target a specific MAC address (PHY).
- **Ping – Are you there?**
  - Transmission of many data frames are required for the preamble OAM
    - Sending a single Clause 57 OAM Ethernet frame is more efficient.

Other OAM use on 10BASE-T1S?

- **Remote Signal Control/Sense**
  - Assign OAM bits to control general purpose digital outputs, or sense an input?
  - Assign OAM bits to individual PHY to wake up?
  - Breaks the OSI layer model.
- **Master Broadcast**
  - Possible use to instruct all PHY on mixing segment to enter a diagnostics mode
    - Acknowledgement is not necessary.
    - Use a different method of returning results due to lack of addressing and arbitration.
    - Only one PHY can be designated as transmitter

Conclusion

- **T1S Preamble OAM is impractical.**
  - No idle side-channel communication when not transmitting as there was in 1000BASE-T1.
    - Standard Clause 57 OAM can be implemented without additional complication to the PHY.
  - OAM will not work with multi-drop mixed segments.
    - No PHY addressing, arbitration; acknowledgement issues
    - No room in the preamble to properly address these issues
  - Preamble OAM does not provide enough system improvement over Clause 57 OAM to justify added PHY complexity.
    - Open Alliance may standardize Clause 57 for automotive use, and propose changes adapting it for use in mixing segments.

REFERENCES

References (General)

- **Standard OAM**
  - Operations, Administration, and Maintenance (OAM)
    - IEEE Std 802.3-2015, Clause 57, Annex 57A

References (802.3bp)

- **1000BASE-T1 (802.3bp)**
  - Physical Layer Specifications and Management Parameters for 1 Gb/s Operation over a Single Twisted-Pair Copper Cable
    - IEEE Std 802.3bp-2016
  - Proposal for an OAM channel v.0.1
    - Schmutzler, Larios, Matheus, et-al.
    - http://www.ieee802.org/3/bp/public/nov14/Matheus_3bp_01_1114.pdf
  - OAM Proposal
    - William Lo
    - http://www.ieee802.org/3/bp/public/jan15/Lo_3bp_02_0115.pdf

References (802.3bp)

- Idle Request During LPI Using OAM
  - William Lo
  - http://www.ieee802.org/3/bp/public/jan15/Lo_3bp_03_0115.pdf
- 1000BASE-T1 OAM Proposed Text
  - William Lo
  - http://www.ieee802.org/3/bp/public/jan15/Lo_3bp_04_0115.pdf
- OAM Data Transfer During LPI
  - Graba, Tu, et-al.
  - http://www.ieee802.org/3/bp/public/jan15/graba_3bp_01_0115.pdf

References (802.3bp)

- 1000BASE-T1 OAM Additional Proposed Text
  - William Lo
  - http://www.ieee802.org/3/bp/public/feb15/Lo_3bp_01a_0215.pdf
- OAM FEC During LPI
  - Graba, Tu, et-al.
  - http://www.ieee802.org/3/bp/public/feb15/graba_3bp_01a_0215.pdf
- 1000BASE-T1 Registers Proposed Text
  - Lo, McClellan
  - http://www.ieee802.org/3/bp/public/mar15/Lo_McClellan_3bp_01a_0315.pdf

References (802.3cg)

- **10BASE-T1S (802.3cg)**
  - Physical Layer Specifications and Management Parameters for 10 Mb/s Operation and Associated Power Delivery over a Single Balanced Pair of Conductors
    - IEEE P802.3cg / D1.3
  - Proposed changes to D1.2 for Clauses 147 and 45
    - Cordaro, Tazebay, et-al.
    - http://www.ieee802.org/3/cg/public/adhoc/cordaro_3cg_02_0509.pdf
  - OAM for 802.3cg 10BASE-T1S
    - Cordaro, Tazebay
    - http://www.ieee802.org/3/cg/public/May2018/8023cg10base-t1s%20OAM.PDF

References (802.3cg)

- IEEE802.3cg TF T1S preamble
  - Beruto, Orzelli.
  - http://www.ieee802.org/3/cg/public/May2018/beruto_3cg_04_0518.pdf