OAM Transport Options

Frames and Preamble

Comparison Criteria

- Bandwidth/Overhead
- Security
- Market Acceptance
- Standardization Complexity
- Implementation Complexity
- Responsiveness
- Fault Localization
- Backward Compatibility and Universality

Bandwidth and Overhead

- Frames
  - Configurable bandwidth usage, N frames/second, each frame k bytes
    - E.g. 5x128B fps = 5 Kbps
    - E.g. 10x256B fps = 20 Kbps
  - In-band, takes away bandwidth from user data
- Preamble
  - Variable bandwidth dependent on frame sizes
  - E.g. .13% < Link speed < 2.4%
  - E.g. 1300 Kbps < 24000 Kbps on GE
  - Out-of-band, does not detract from user data, on p2p links
  - Out-of-band exceptions:
    - Copper - requires transmission of preamble for EoCu links
    - PON – dummy frames take away BW from other stations

Security

- Preamble
  - OAM data is processed in the RS layer and is not accessible to the MAC layer or above
  - Snooping requires capturing preamble - harder
- Frames
  - OAM frames are processed by the MAC control layer because of the destination MAC address and EtherType – they are not forwarded off the link
  - Snooping requires capturing frames - easier

Market Acceptance

- Frames
  - Very simple to implement and easily applicable to all Ethernets
  - Utility of OAM will drive its acceptance, not the bit transport
  - ATM OAM is precedence
- Preamble
  - Can address more than EFM market,
  - Protection capabilities target it at core/metro market as well
  - SONET OAM is precedence

Standardization Complexity (1)

- Preamble
  - Clause 30 (Management) – Add new oRemoteEntity object class
  - Clauses 22 & 35 (RS/MII, RS/GMII) – Support optional OAM transport in preamble, dummy frame generation, etc.
  - Clause 22 & 45 – Add new PHY monitoring registers (S/N ration, RX power, etc.)
  - Clause 36 (PCS 1000BaseX) – Ensure preamble transparency
  - Clause New: OAM preamble format, HDLC encoding, etc.

Standardization Complexity (2)

- Frames
  - Clause 30 (Management) – Add new oRemoteEntity object class
  - Clause 31 (MAC Control) – Add OAM section, describe frame formats and protocol operation
  - Clause 22 & 45 – Add new PHY monitoring registers (S/N ration, RX power, etc.)
  - Annex 30A & 30B – Add OIDs for new managed objects
  - Annex 43B – Add OAM types to Slow Protocols list, possibly modify Slow Protocol definition (allowable frames per second)

Implementation Complexity

- Frames
  - Requires a buffer in device
  - Frame processing and preparation in SW/FW
- Preamble
  - HW in RS for dummy frame generation, preamble write/read
  - HW/FW for HDLC framing, HDLC checksum
  - HW processing for flags (protection)
  - SW/FW processing for messages

Responsiveness & Detection

- Preamble
  - Information transmitted at worst every 1500B (on GE link, << 1 msec delay)
  - Very fast for bit alarms
  - Suggested as method of failure detection and signaling for protection switching
- Frames
  - OAM frames inserted regularly
  - Responsiveness depends on final selected frequency
    - 5 frames/second implies up to 200 msec delay
    - 20 frames/second implies up to 50 msec delay
  - Does not react as quickly as preamble implemented in hardware

Fault Localization for Regenerators

- Frames
  - Must send between minimum and maximum OAM frames per second (at least ingress & egress)
  - Intermediate device (repeater, regenerator) must
    - Buffer entire frame
    - If OAM frame, replace it with its own OAM frame on transmit
- Preamble
  - Every frame has preamble
  - Intermediate device (repeater, regenerator) must
    - Buffer very little (tens of bytes)
    - Replace k preamble bytes with its own preamble bytes

Universality and Backward Compatibility

- Preamble
  - Requires hardware upgrades to operate over existing Ethernets
  - Existing MAC chips with integrated RS cannot be utilized
- Frames
  - Can be implemented with software or firmware upgrade for operation on existing Ethernets
  - Can be used with all existing HW components

Decide for yourself

	Importance	Frames Grade	Preamble Grade
BW/Overhead			
Security			
Market Acceptance			
Standards Complexity			
Implementation Complexity			
Responsiveness and Protection			
Fault Localization			
Backward Compatibility and Universality			