EFM OAM
Common Protocol Proposal

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EFM OAM Function

- **Common for all EFM PHY (& existing PHYs)**
- **Link Monitor:**

  Each layer to store error status / counter. How to signal to remote ?
- **Remote Defect Indication:**

  How to signal defect to remote (especially from CPE to HE)
- **Remote Loop Back:**

  Connectivity Test. : Request & Response.

→ ***Needs "Remote OAM Transport" capability***

3 Implementation Options

- **MAC Control Frame**
- **PHY Specific (Cu-Out-of-band Ch, Dedicated EPON Time Slot, IPG)**
- **MAC/PHY Sub-layer (Preamble)**

1: OAM at MAC Control layer

- **OAM at MAC Layer (eg. MAC Control Frame)**
  - **–Common for all EFM PHY,**
  - **–Flexible capabilities**

  But

  - **–Not Secure, since visible to MAC.**
  - **–Impact on user traffic / bandwidth.**
  - **–Will be Software / Slow / Expensive Implementation ?**
    (How is it different from SNMP ?)
  - **–Non timing sensitive**
  - **–Relying on PHY/MAC to work properly.**
  - **–MAC Control Frame is out of scope of EFM ?**
  - **–Can not address PHY layer Demarcation model ?**

2:OAM at PHY Layer

- **OAM at PHY Specific**
- **(EOC in Copper, EPON Time Slot Preamble, GE-P2P PCS Coding)**

  –Invisible to MAC and secure

  –Out of Band (no impact on user traffic)

  –Fast HW implementation, Good for Timing sensitive

  –Can Address PHY demarcation point model

  But

  –Not common to all EFM PHY = Expensive, Slow Standardization

  –Changes on existing PCS (such as manipulating IPG / 8B10B) not preferable

3: OAM at MAC/PHY Sub-layer

- **MAC/PHY Sub-Layer “On Preamble “**

  –Invisible to MAC, secure and common to all EFM PHYs

  –No overhead, No impact on user traffic

  –HW implementation / Good for Timing Sensitive

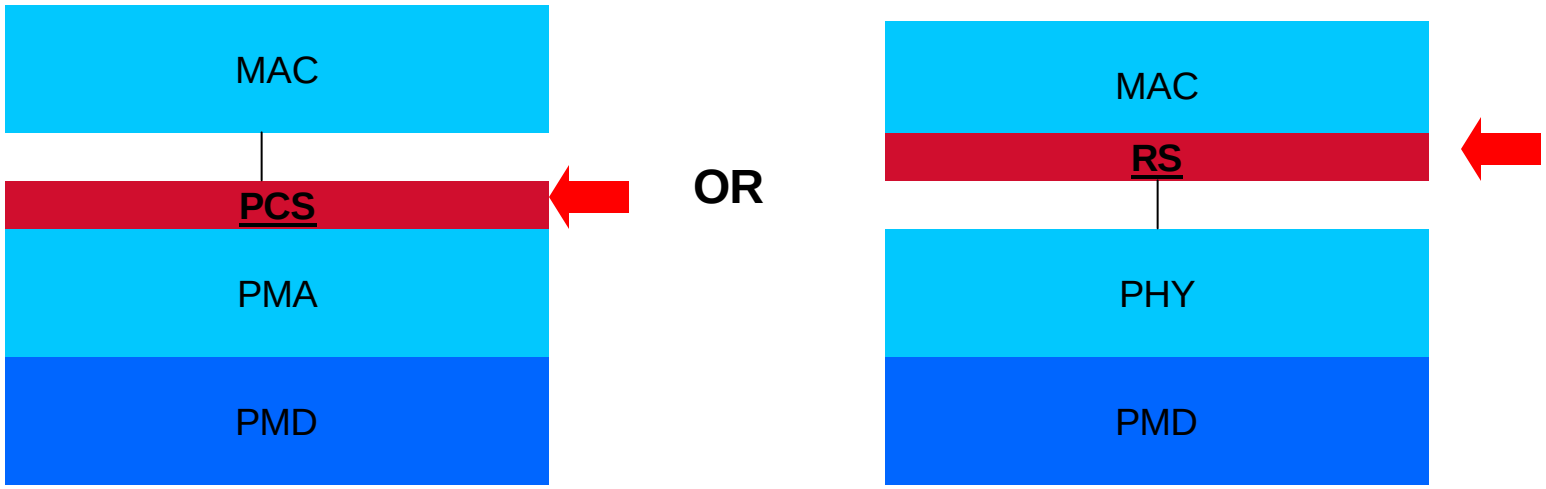
  –Can match with PHY demarcation point (Media Converter) model

  –per_logical_port OAM by combination with Logical PHY ID, possible

  But

  –Only 2-4 byte on preamble

OAM on MAC/PHY Sub-Layer

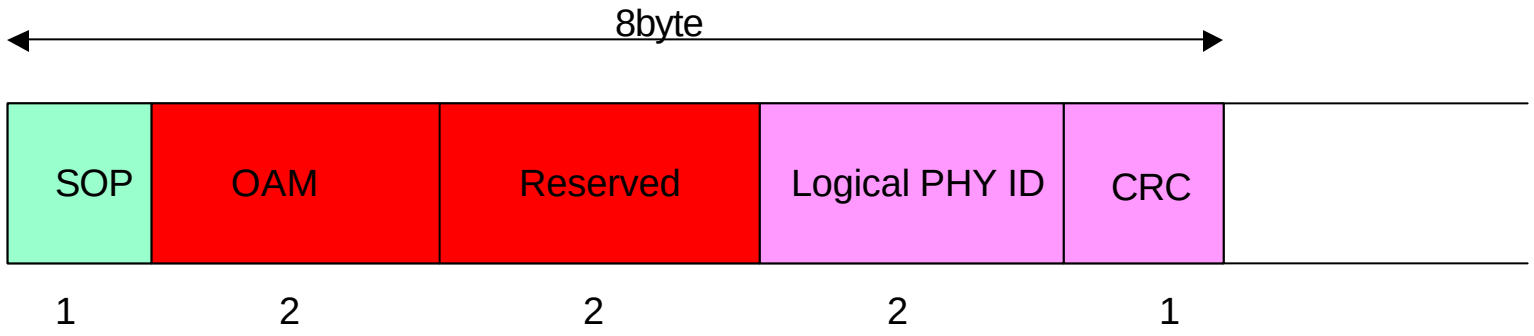


- **OAM MAC/PHY Sub-Layer**

(This is the similar to Logical PHY ID Layer in EPON)

OAM on Preamble

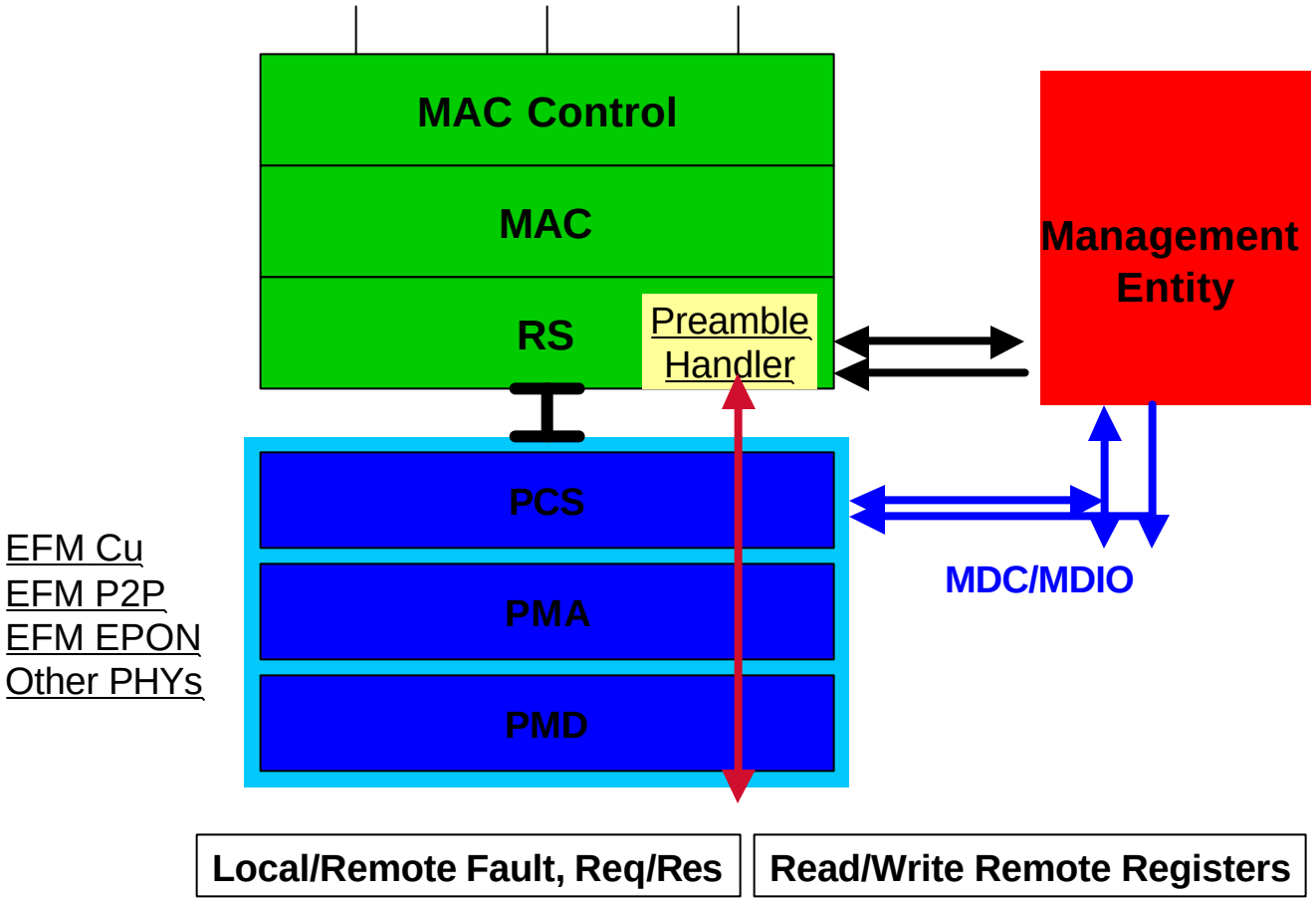
- **8 byte Preamble to carry:**
  - **2-4byte : OAM (Defect Indication, Link Monitor Report, Loopback)**
  - **2byte : Reserved for Logical PHY ID**
  - **1byte : CRC**
- **If there is no data frame, generate a dummy frame.**
- **When passing a frame to MAC, convert back to the normal preamble.**



OAM Bytes on Preamble

- **Type & Defect Indication Byte**
  - 2bit :Type Field (Normal or OAM preamble)
  - 6bit :Code Points for Local / Remote Fault / Dying Gasp / Loopback
- **Ethernet Control Channel (ECC) Byte**
  - Link Monitoring (read / write remote registers)
  - Packets with encapsulation (HDLC) over ECC bytes
- **Reserved Bytes**

How it works with Management Entity (RS model)



A Proposal

- **MAC/PHY Sub-Layer (Preamble)**

  OAM invisible to MAC but common to all EFM PHYs

  For basic and common OAM function (Defect Indication, etc)

- **Combine with PHY dependent mechanism for PHY Specific OAM,**

  Such as

  Copper-Out-of-band Ch. for Copper Link state control

  EPON Control Frame / Dedicated Time Slot for EPON Upstream access managements

Example

	EPON	P-P Fiber	P-P Copper
Preamble	**Remote Defect Indication** **Dying Gasp** **Remote Link Monitor (R/W Remote Registers)** **Loopback (Request / Reply)**		
PHY Specific **If needed**	**Slot allocation & Ranging by control frame**	**n/a**	**Link State Control by Copper Out-of-band**

Conclusion

- **Common OAM for EFM PHYs.**
- **MAC/PHY Sub-layer to carry Remote OAM over Preamble**

  Invisible to MAC, Very secure,

  Short latency

  No overhead, no impact on user traffic bandwidth
- **Combine PHY specific function over PHY specific mechanisms**