

# **OAM Support in Copper and Mixed Copper/Fiber EFM Systems**

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**IEEE 802.3ah EFM Task Force  
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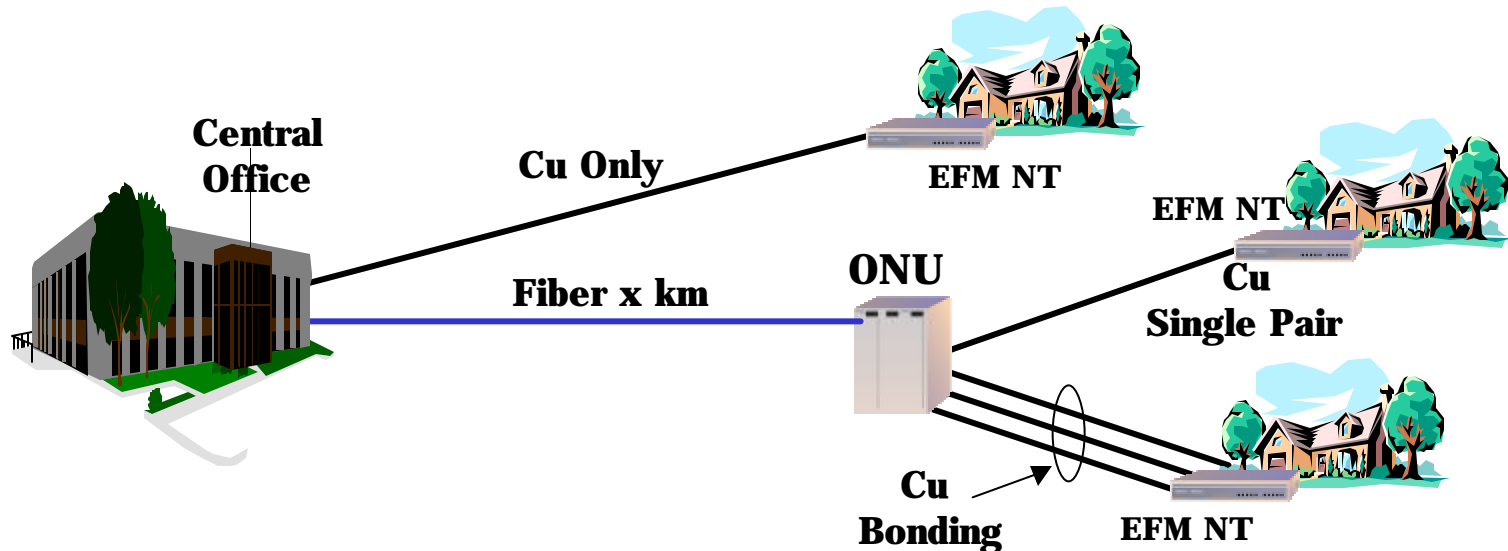
# Issues To Discuss

- **Architecture considerations for mixed Fiber/Copper EFM OAM**
- **Architecture issues for EFM OAM, specific to loop- aggregated Copper**
- **Existing OAM transport methods for Copper**
- **Possible new OAM transport for Copper**
- **Mapping of Copper OAM to Fiber OAM**
- **Summary**

# Architecture Considerations for EFM OAM

- **Combination of Fiber and Copper EFM Architecture necessary for evolution from Copper to future Fiber Access Network**
- **Need Agreement on EFM Cu OAM Architecture, ideally...**
  - **EFM Copper OAM MIB should be identical to EFM P2P OAM MIB and EFM P2MP MIB**
  - **EFM Copper also requires OAM support for N- pairs (bonding or loop- aggregation)**
- **Choices complicated by optional/mandatory use of Preamble and/or Frame based OAM**

# Mixed Fiber/Copper EFM

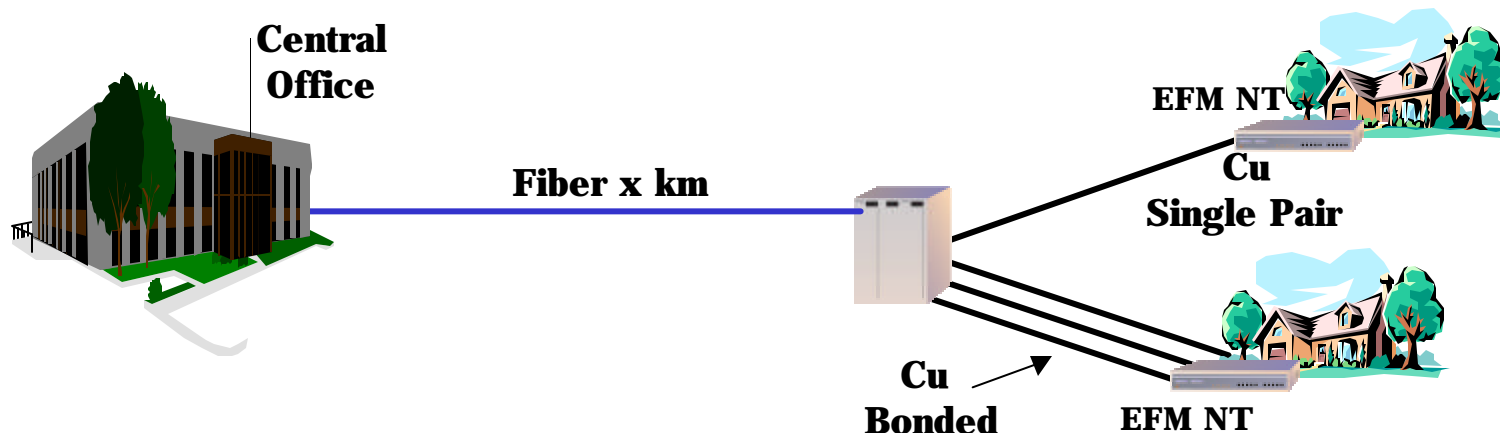


- **Mixed Optical- Fiber Architecture Models**
  - **ONU separately managed?**
    - EFM management “only” on Cu
  - **Management on End- to- End basis?**
    - OAM from CO to subscriber over multiple links is out of scope for EFM

# Mixed Fiber/Copper Management Issues

- **ONU separately managed Model**
  - Easy extension of Copper only case
  - Guaranteed service level complicated
  - Need separate channel from ONU for EFM management information
  - Or make copper work like EPON (muxing protocol)
- **OAM End- to- end Model is out of scope for EFM**
- **VDSL Management Non- Symmetric**
  - VTU- 0 acts as “master”
  - Requires addressable client at ONU
  - Management of VDSL link at ONU includes access of portions of EFM NT device (slave)

# Copper Loop Aggregation Issues



- **EFM MIB at CO (for fiber) should be identical to EFM MIB at ONU (for copper)**
- **EFM MIB at ONU for single copper pair should be identical to EFM MIB for bonded pairs,**
  - or
- **EFM MIB includes adaptation layer for bonded pairs**

# OAM Transport for Copper

- **VOC (VDSL Overhead Channel)**
- **EOC (Embedded Operations Channel)**
- **IB Bits (Indicator Bits)**

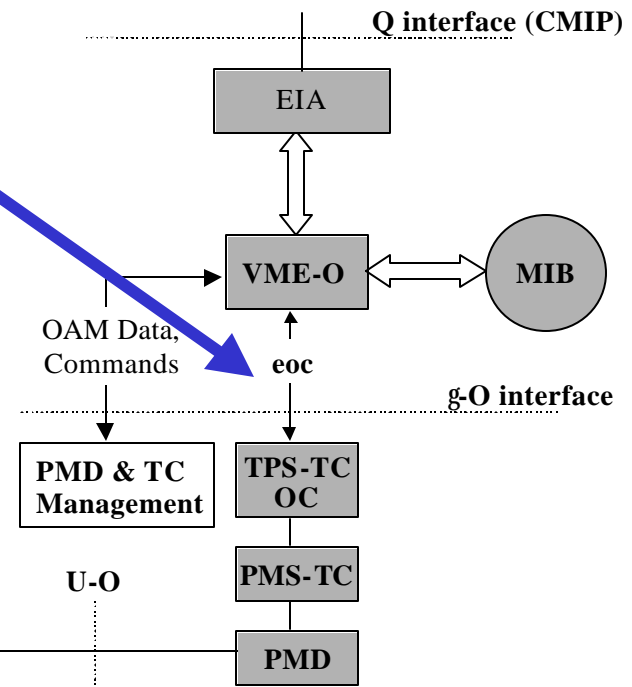
# Copper OAM transport - VOC

- **VOC (VDSL Operations Channel)**
  - **Used internal to VDSL for line- related config and control**
  - **Echoing protocol defined in T1E1 trial Spec adds delay**
  - **Not available at g interface**



# Copper OAM transport - EOC

- **HDLC based framing at g interface**
  - **Higher layer VME functionality defines VDSL related management commands and multiplexes internal external EOC messages**
  - **Internal EOC uses MIB and protocol to read registers in VTU- R**
  - **VME uses echoing protocol**



MIB - Management Information Data Base

VME - VDSL Management Entity

EIA - External Interface Adapter

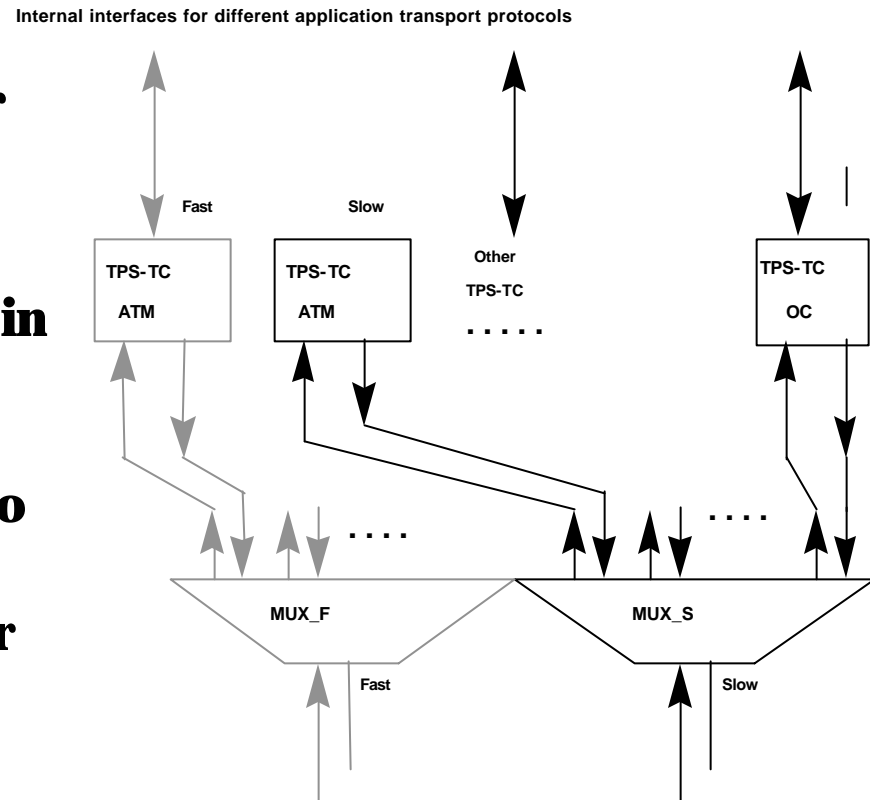
# Copper OAM transport - IB

- **IB (Indicator Bits)**
  - **Far- end time- sensitive defect and failure indicators inserted into defined bits in VDSL frame header.**
  - **Upstream/downstream independent**
  - **Not available at g interface, very low layer function**
  - **Limited transmit capability**
  - **Most like OAM- in- Preamble proposal for EFM P2P and P2MP OAM**

# EFM OAM Possibility

## Define New TPS- TC for EFM Management

- **New TPS- TC can be defined custom made for EFM OAM**
  - **Clear cut at g interface**
  - **Master/Slave relationship in VDSL management gone**
  - **Loss of Master/Slave relationship requires NT to be addressable**
  - **EFM may need to consider replacement of VME with new transport**



# Mapping Copper OAM to Fiber OAM

- **EFM Fiber OAM: OiF mandatory, OiP optional for faster alarms**
- **EFM Copper OAM:**
  - **Could be OiF mandatory, OiB optional for faster alarms, OiVOC/eoc optional as well for lowest performance using existing TPS-TC/VME- 0,**  
**-- or --**
  - **Could be OiF mandatory, OiNewTPS-TC/VME- 0 optional**

# Copper OAM Transport Summary

<b>Method</b>	<b>Pros</b>	<b>Cons</b>
<b>VOC</b>	<b>Existing method for limited management purposes</b>	<b>Slow, no gamma interface</b>
<b>EOC</b>	<b>Existing method</b>	<b>Slow with VDSL VME</b>
<b>IB</b>	<b>Fast, most like alarms in optic OAM- in- Preamble</b>	<b>No gamma interface, missing EFM PHY loopback</b>
<b>New TPS- TC</b>	<b>New gamma interface, new VME transport possible</b>	<b>New. Addressable client at NT likely</b>

# Conclusion

- **EFM Cu/OAM should select OAM Architecture model**
- **Copper Track should select EFM OAM transport method(s)**