# OAM in Preamble FAQ

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# Purpose

- **Support and backup the OAM Baseline proposal (squire_2_0502)**
  - **MAC layer OAM: Frame ( Mandatory )**
  - **Physical layer OAM : Preamble ( Optional )**
- **Answer Frequently Asked Questions about OAM in Preamble as it is a new concept**
  - **Where OAM in Preamble is specified / implemented ?**
  - **Why OAM in Preamble is useful ?**
  - **Why OAM in Preamble is fast ?**
  - **:**
  - **:**

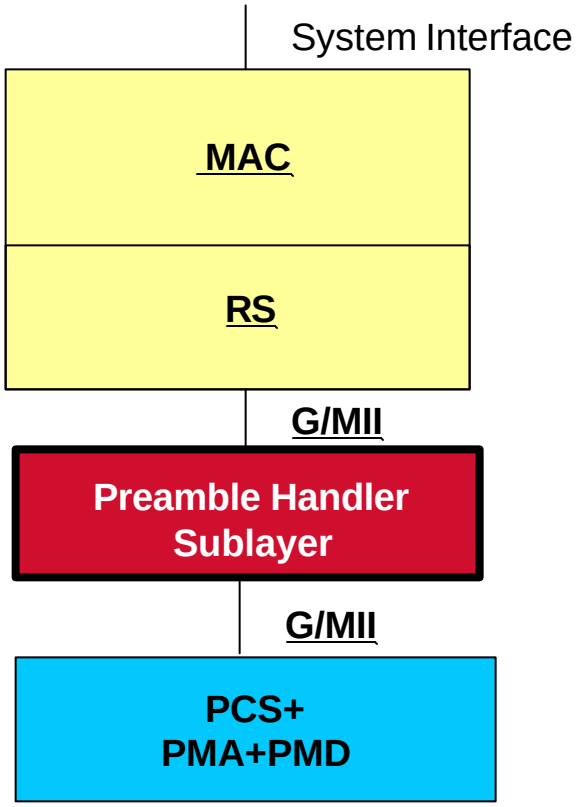
# OAM Transport Usage

| OAM Transport | What it is ? | Functions | Implementation | Recommended Applications |
|---|---|---|---|---|
| MAC OAM | OAM in Frames<br><br>Basic OAM | Link Monitor<br>Basic Defect Indication<br>MAC Layer Ping | Can be implemented in SW | All EFM<br>All Full Duplex Ethernet |
| PHY OAM | OAM in Preamble<br><br>High-Performance OAM | Fast Defect Indication<br>PHY Layer Ping | HW Implementation | P2P / P2MP<br>Not for Copper<br>All Full Duplex Fiber |

# PHY OAM Features

- **PHY OAM provides**
  - **Physical layer Ping**
  - **Physical layer Defect Indication**
  - **Physical layer General Alarms**
  - **Autonomous Action to Alarms in HW**
- **Why is PHY OAM needed?**
  - **Physical Layer Health Check and Fault Isolation**
  - **Fast Defect & Alarm Indication, in proportion to Link Speed**
  - **No impact on Customer BW in Service Provider Environment**
  - **Not visible to MAC and Customer in Service Provider Environment**

# PHY OAM Specification




## PHS: Preamble Handler Sublayer

- Define Preamble Handler Sublayer
- It is located below RS layer and above PCS across GMII/MII
- Specified in a NEW CLAUSE
- Allows implementation flexibility

# Health Check Requirements

- **Failures could be in:**
  - **Higher layers ( IP or Bridge )**
  - **MAC layer**
  - **PHY layer**
- **Fault Isolation provided by:**
  - **MAC OAM Health Check**
  - **PHY OAM Health Check**

# P2MP OAM

- 16-32 or more ONUs managed by a single OLT
- Per ONU management may utilize secure PHY ID
- P2MP OAM utilizes both P2P OAM and PHY TAG in Preamble

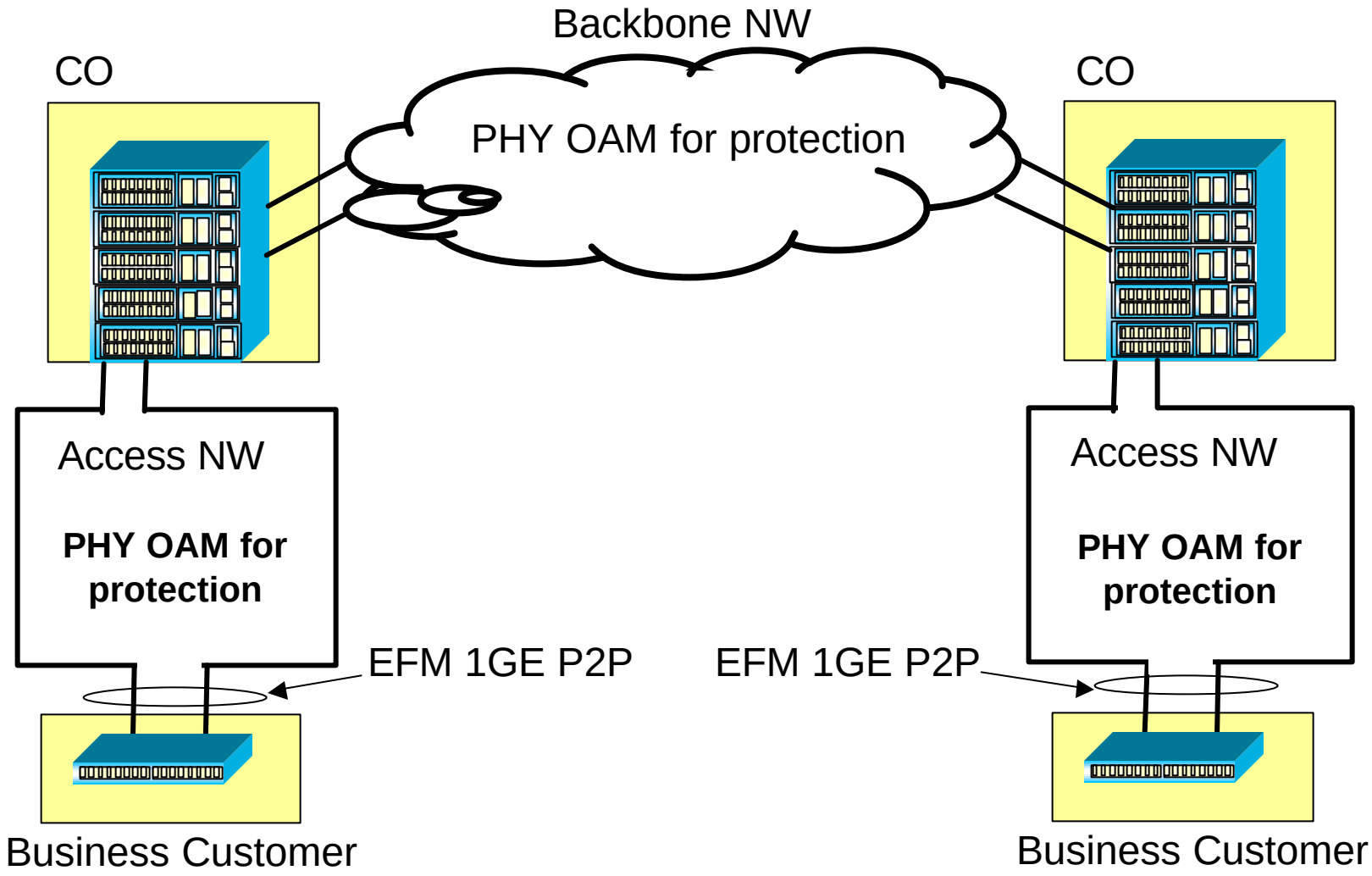
- Generating 32 or MORE OAM frames to all ONUs has big BW impacts
- PHY OAM has No BW impact

- 1msec Slot Cycle time enables 1msec order of Defect Indication, if using HW-based OAM, i.e. PHY OAM.

# P2P OAM

- **EFM P2P GE usage includes Business Users in a Service Provider Environment (T3/SONET/SHD link alternative)**
- **PHY OAM enables:**
  - **Fast "Physical Layer Protection", equivalent to SONET/SDH 50msec fail-over**
  - **No Impact to Available User BW**
  - **Not Part of the Customer Data Traffic (DA through CRC)**

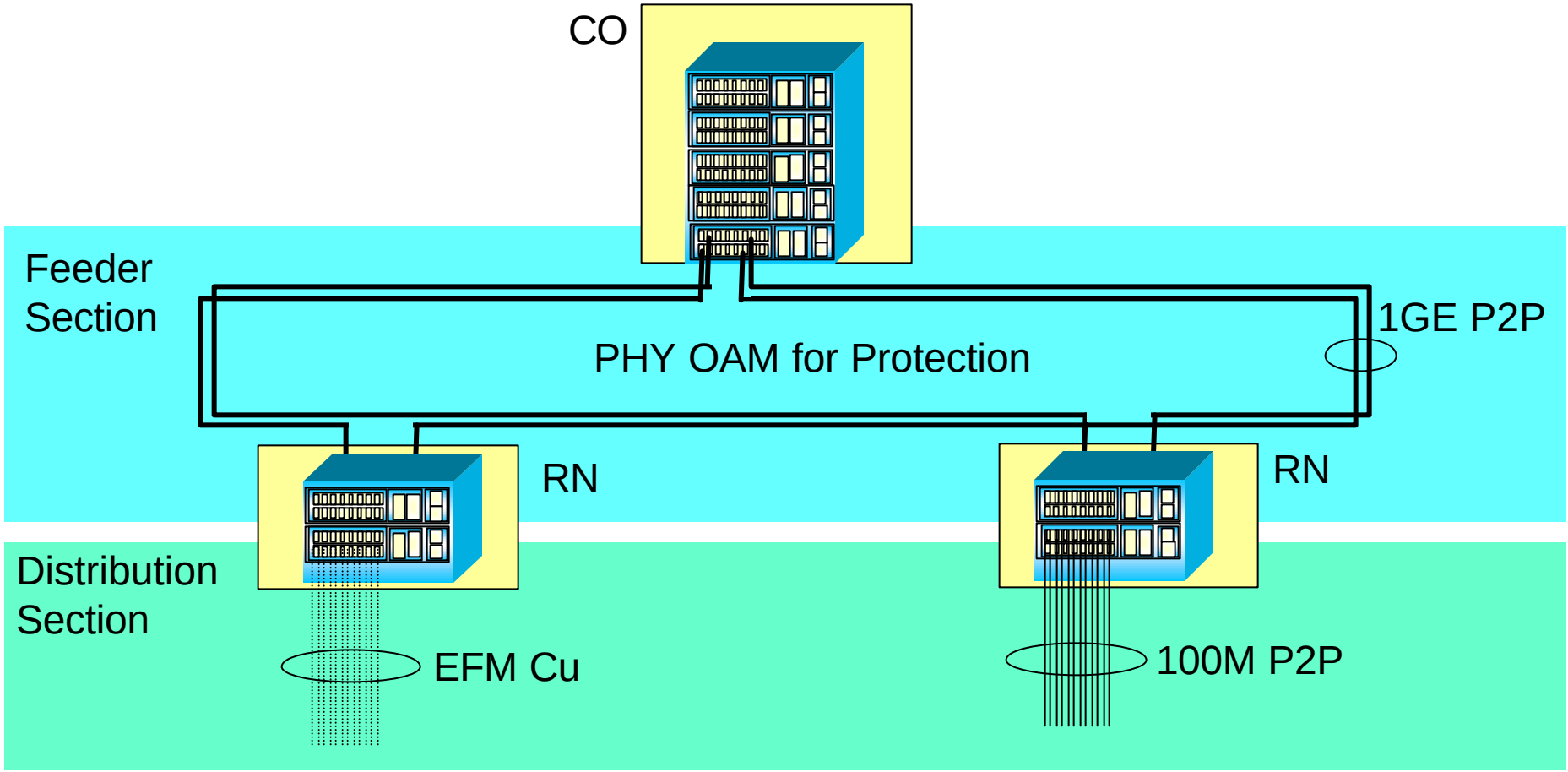
# Protection Application for Business Customers & CO-CO



# Hybrid Cu & P2P OAM

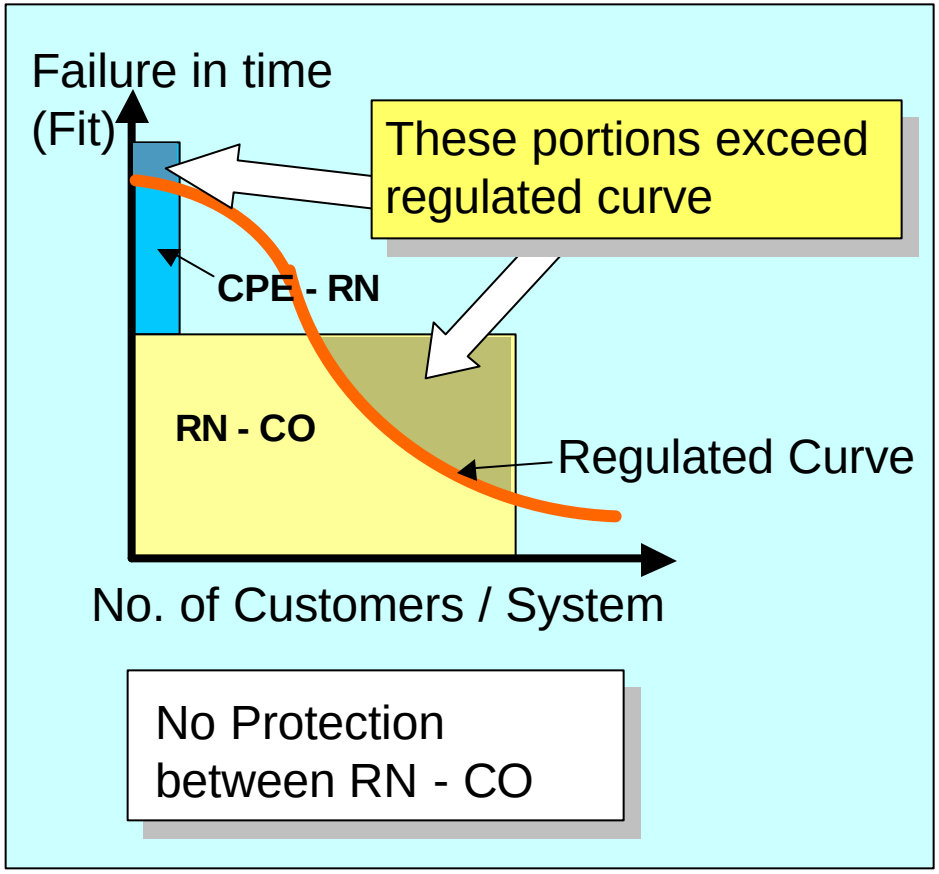
- **P2P 1GE will be used for Remote Node - CO, as an alternative to OC-3/SONET/SDH**
- **Typical DSLAM has Two OC-3 Interfaces (support 50msec fail-over)**
- **Hybrid EFM Requires Fast Protection Signaling without impacting customer BW and autonomous action below the MAC layer**

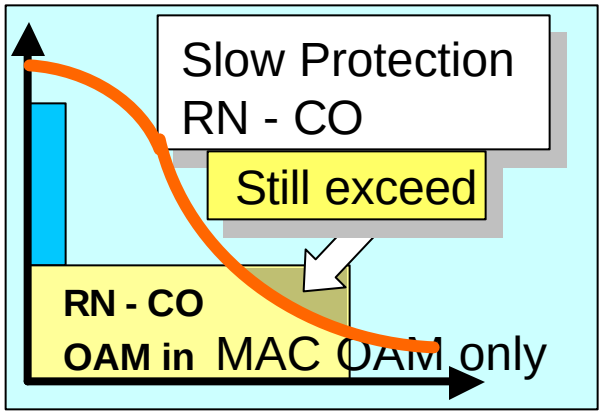
# Protection Application for Hybrid Network (Residential Customers)

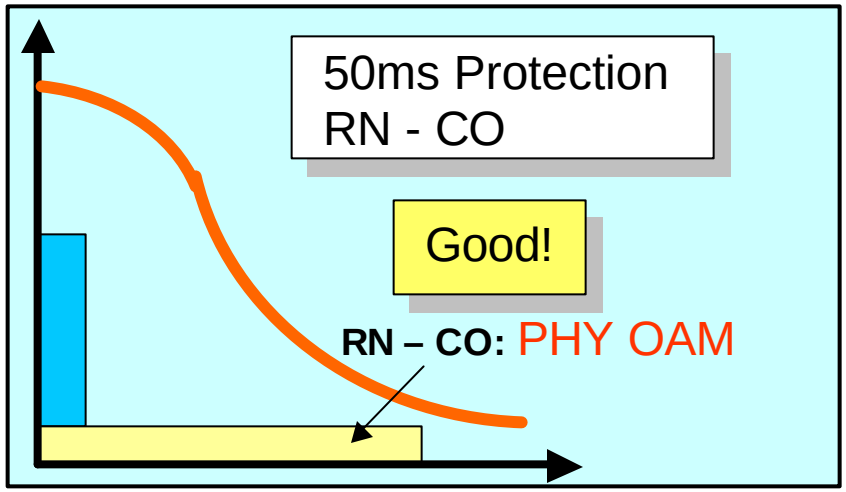


# Fast Protection Requirements

- **Maintain Current Service Level**

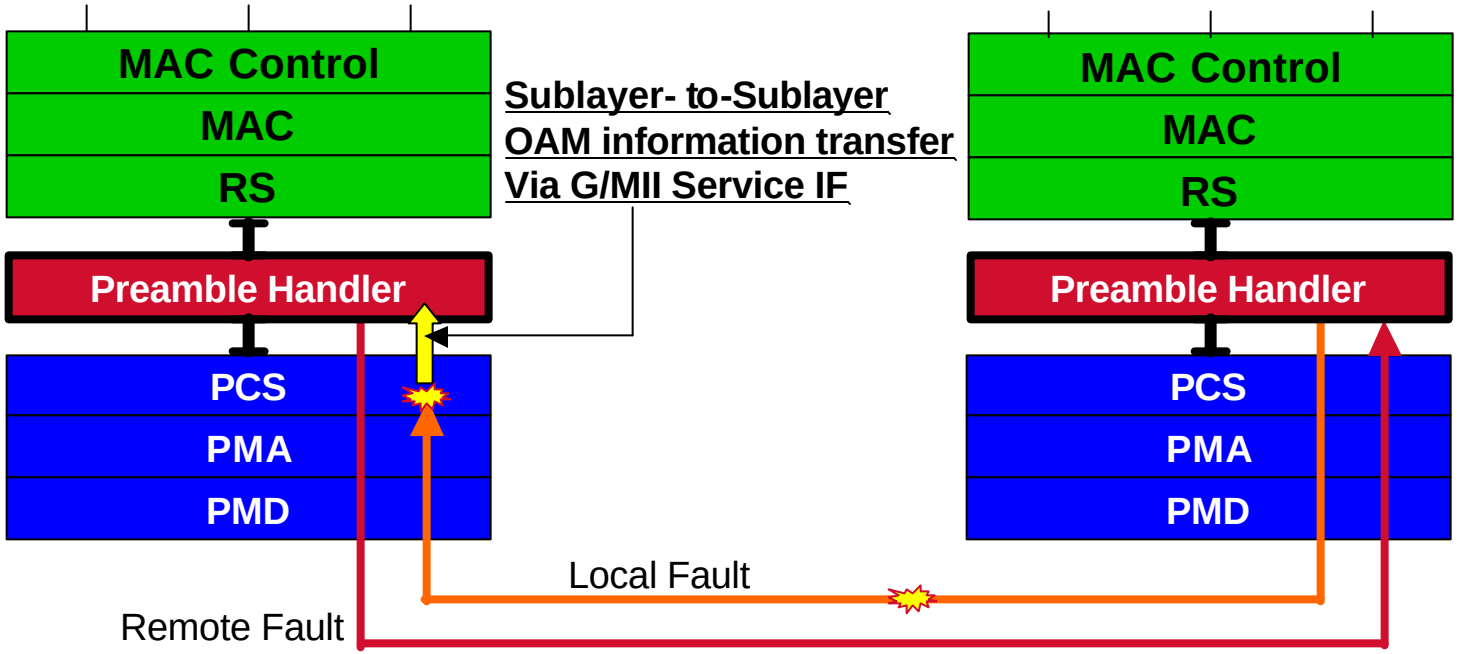


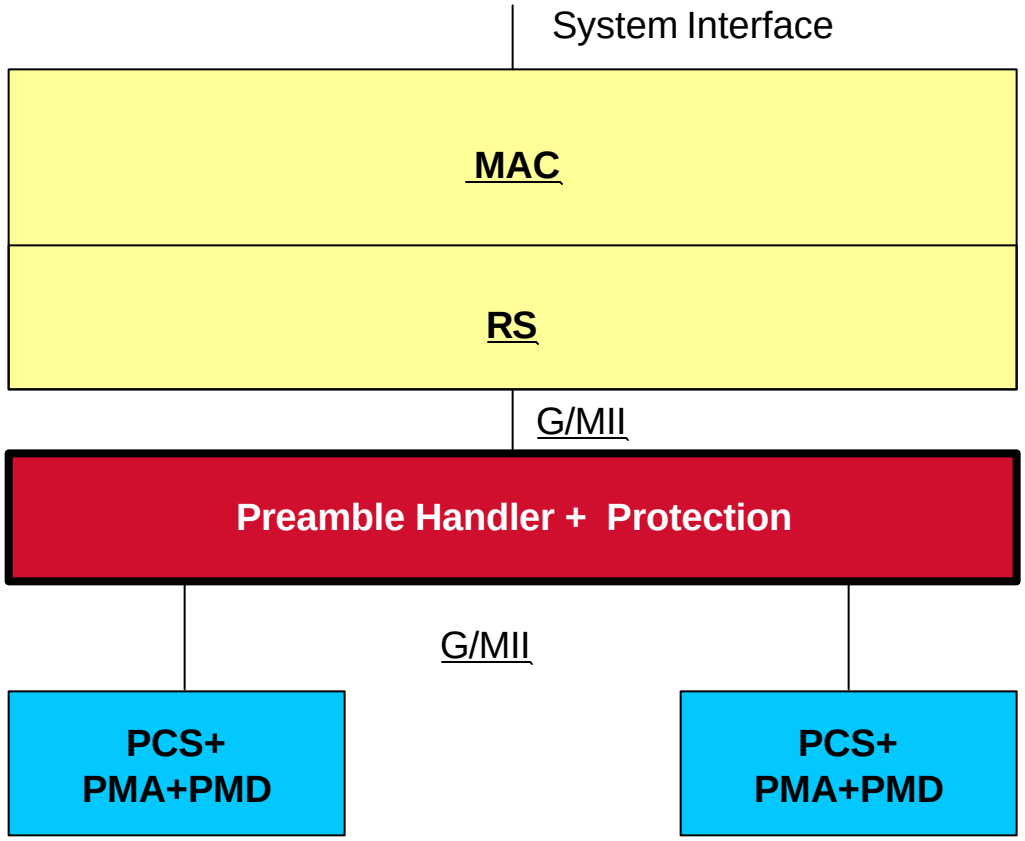



# Fast Fault Detection

- **When PHY Rx detects a Fault:**
  - **PHY signals Local Fault to Preamble Handler Layer in RX direction**
  - **Preamble Handler signals Remote Fault in Tx direction**
- **Hardware Fault Indications (Autonomous Action to Alarms)**
- **Sublayer to sublayer OAM information passed via Service Interface**



# Protection Example




***Physical Layer Protection***

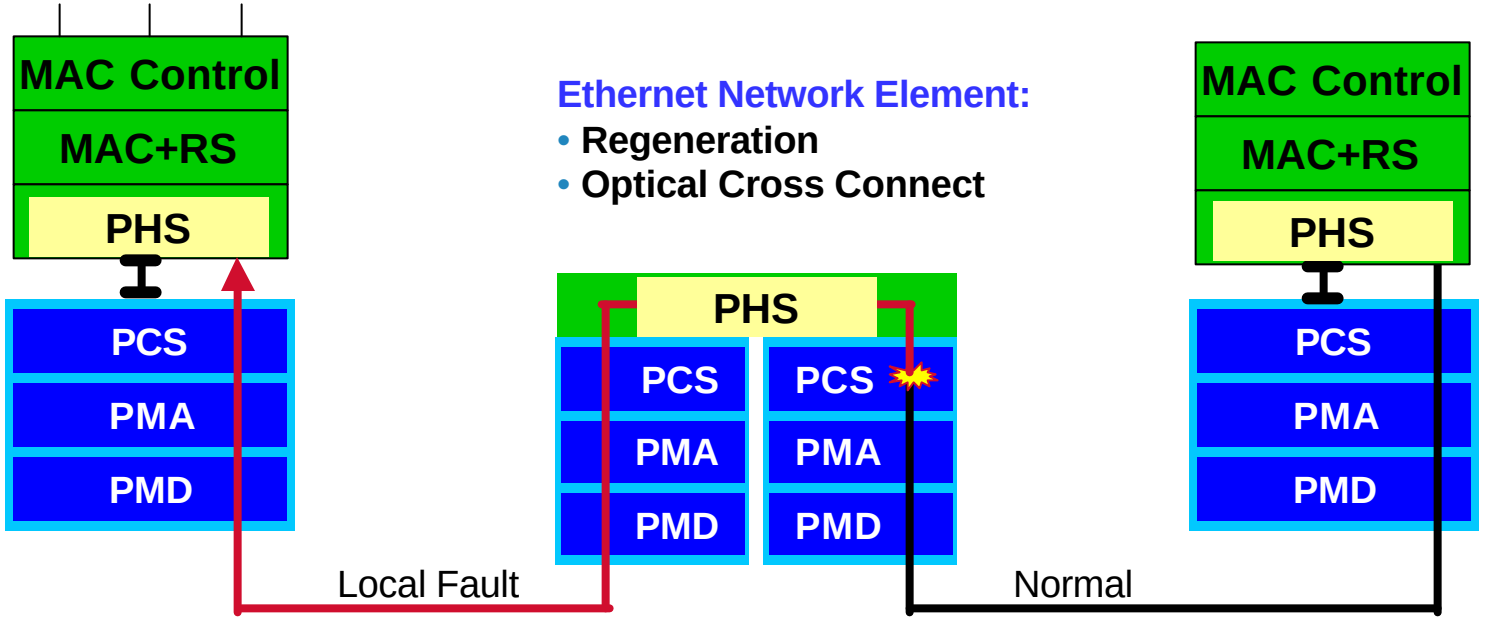
# Service Provider OAM Requirements

- **Ethernet Subscriber Access Networks ( EFM )**
  - CO to CPE
  - Mainly remote link monitoring
- **Metro Ethernet Network / High-end Router Network**
  - CO to CO
  - Mainly Protection & Fault Defect Indication (Line & End-End)
  - Transparent LAN service management / Replacement of POS
- **Ethernet over Dark Fiber / DWDM**
  - Ethernet Regenerator / Transponder for extended distance
  - Out-of-band is mandatory: Frames never inserted by optical nodes
  - Can't impact available customer link bandwidth
- **These are also solved by PHY OAM (thanks to EFM!)**

*Already Happening !!*

# Optional Features of OAM Fault Indication

- "Ethernet Network Element (ENE)" includes OAM in Preamble Handler
- PHS generates and terminates Local and Remote Fault
- PHS-to-PHS link-based Fault reflection across multiple link segments



# Extension to Metro / Core

- It's difficult for Ethernet Network Elements to support MAC OAM
- Simplest solution for Ethernet OAM over Dark fiber is PHY OAM
- Possible usage of PHY OAM for Metro Optical Ethernet Networks:
  - -IP over PPP over HDLC for Optical Management Channel ( GMPLS etc )
  - -Defect Indication Hop-by-hop & End-to-End Level
  - -Linear Automatic Protection Switch ( SONET K1/K2 byte )
  - -End-End ( SONET Path like ) OAM functions ( Path Tracing )
  - -802.17 RPR over Ethernet PHY with OAM

# Conclusion

- **Service Providers need robust & complete OAM support**
  - **Out-of-band / No impact on User traffic**
  - **50msec Fail-over support**
  - **Can be applied to Optical / DWDM / Regen / PHY demarc device**
  - **More Secure**
- **We need *Both* PHY and MAC OAM transport specified.**