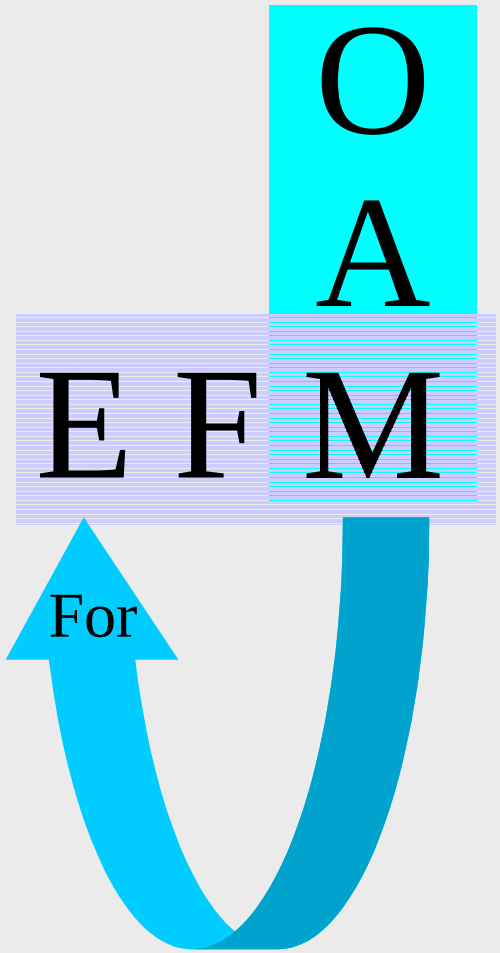


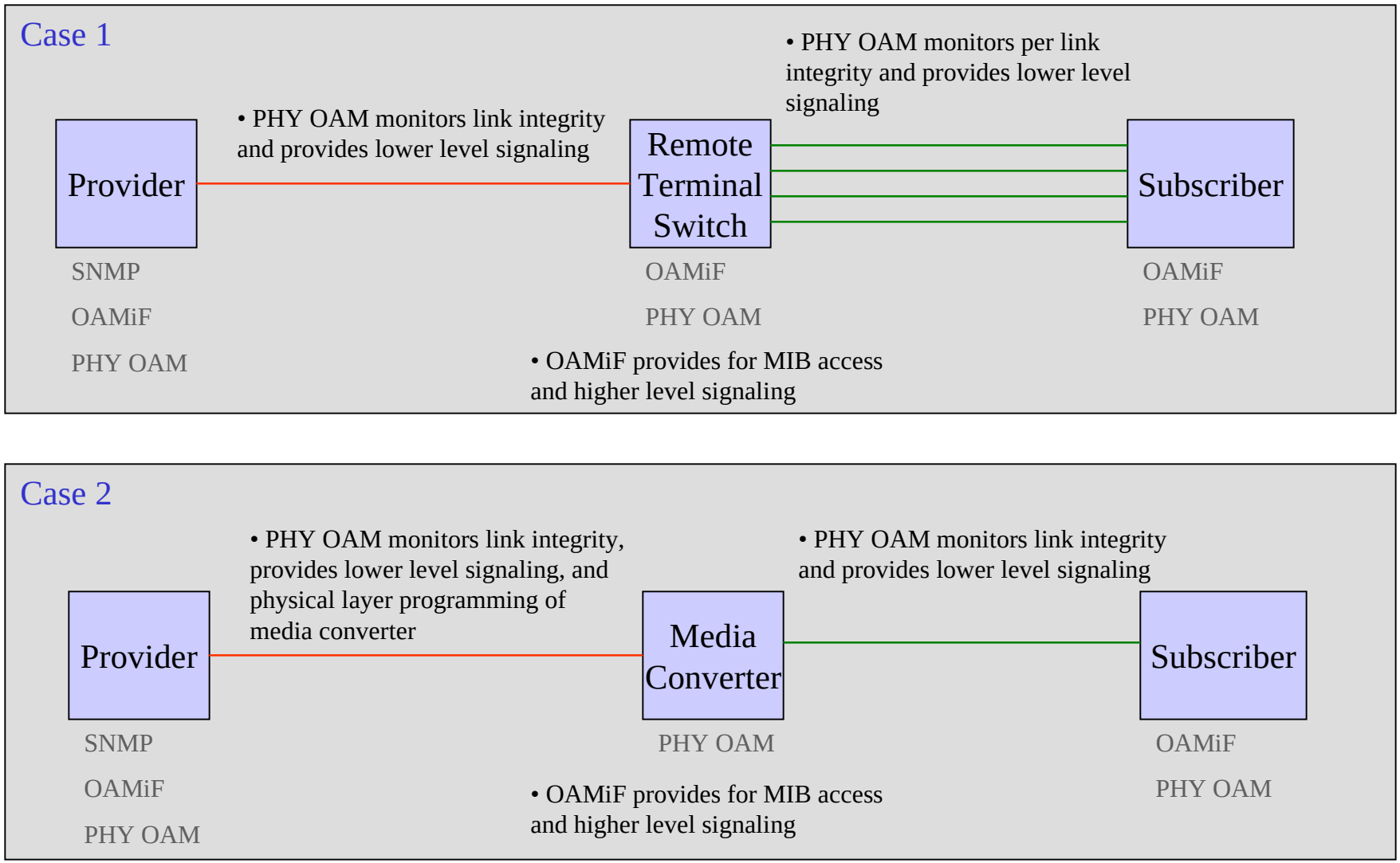
PHY
OAM

George Claseman
Micrel - Kendin Operations

PHY OAM Overview

- Provides low level error checking of individual links
- Used to control and monitor devices that do not have the ability to converse with frame based OAM
- Can be used for immediate fatal error signaling allowing for last gasp conditions
- Provides enough architectural space for addressing, error reporting and future enhancements
- Can be used over coded asynchronous or synchronous links either coded or uncoded

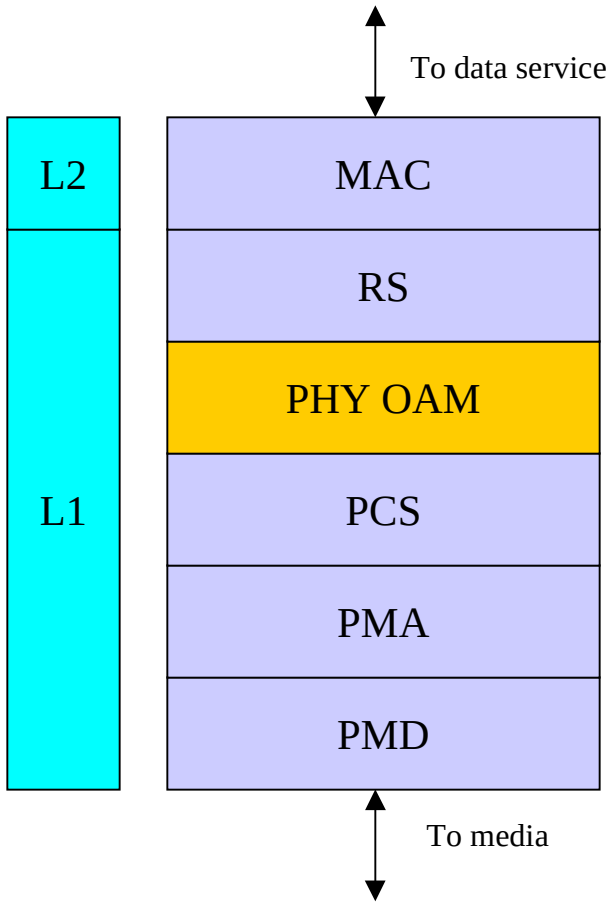
Managing The First Mile



The PHY OAM Proposal

- Provide a data frame independent method of low level management of links
- Works with frame based OAM for a complete management system
- Needed to extend monitoring and low level management into devices that are traditionally unmanaged
- Needed for bonded or aggregated links for fault isolation
- Used for fast alarm signaling where needed

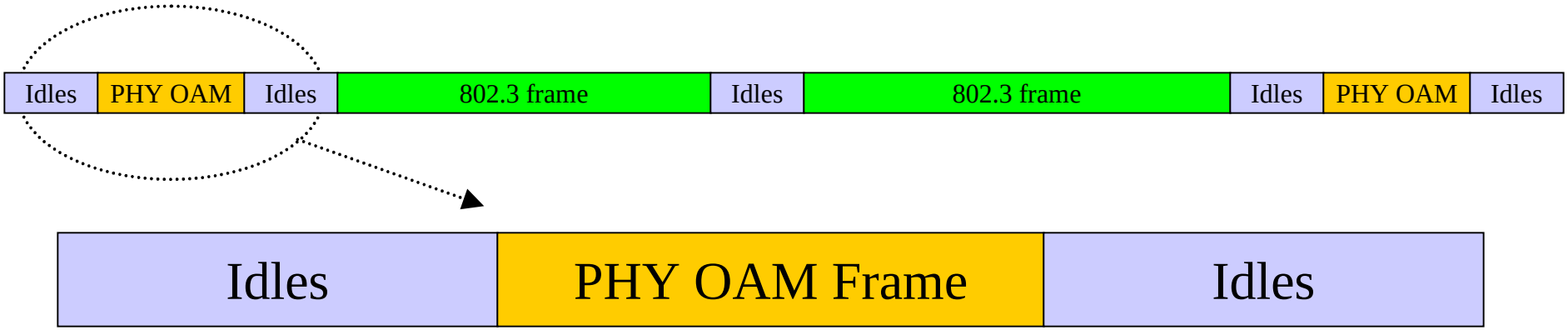
PHY OAM in 802.3 Protocol Stack



- Uses standard RS to connect

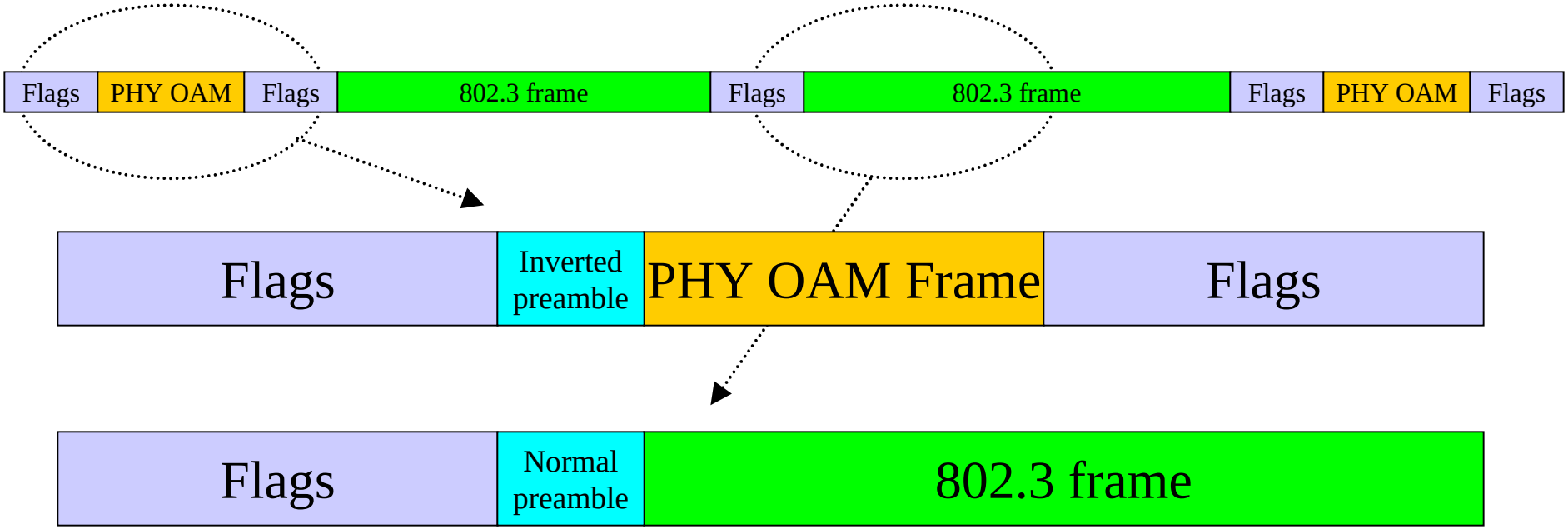
- Connects to existing PCS interfaces
- Requires digital modification to PHY

PHY OAM Transport



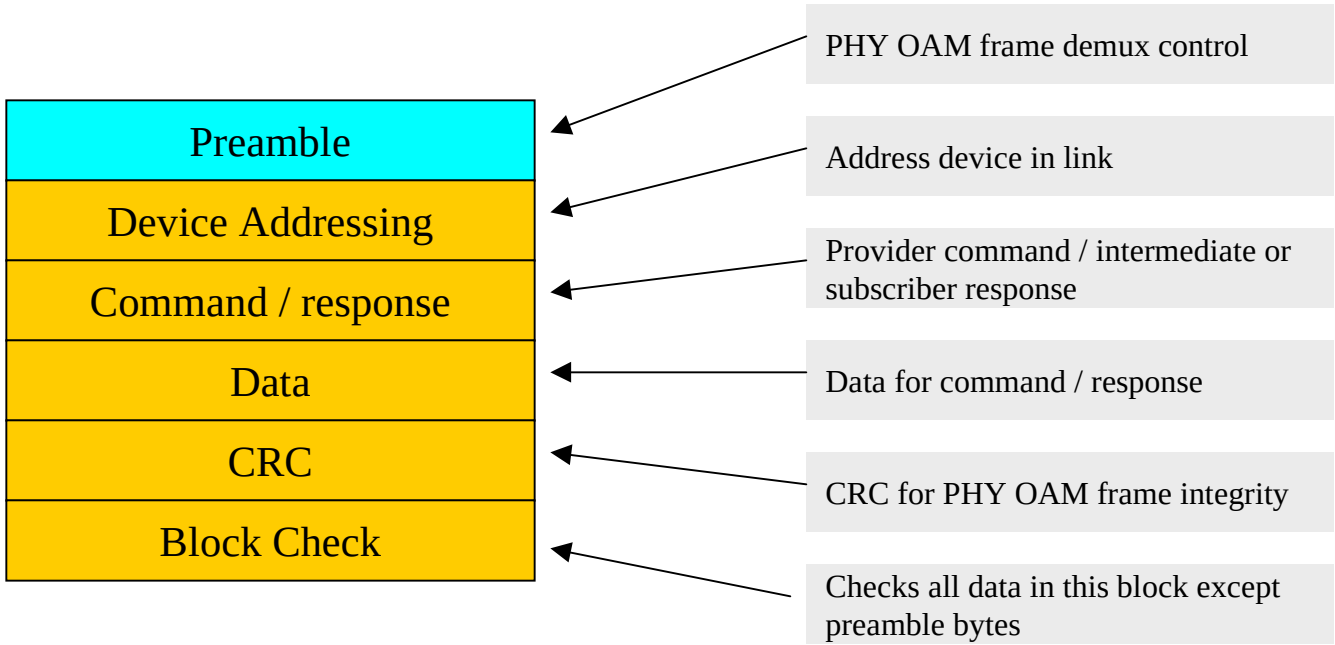
- Runs in between frames
- Uses special preamble for demux function
- Maintains IPG

PHY OAM in Copper PHY using HDLC Framing

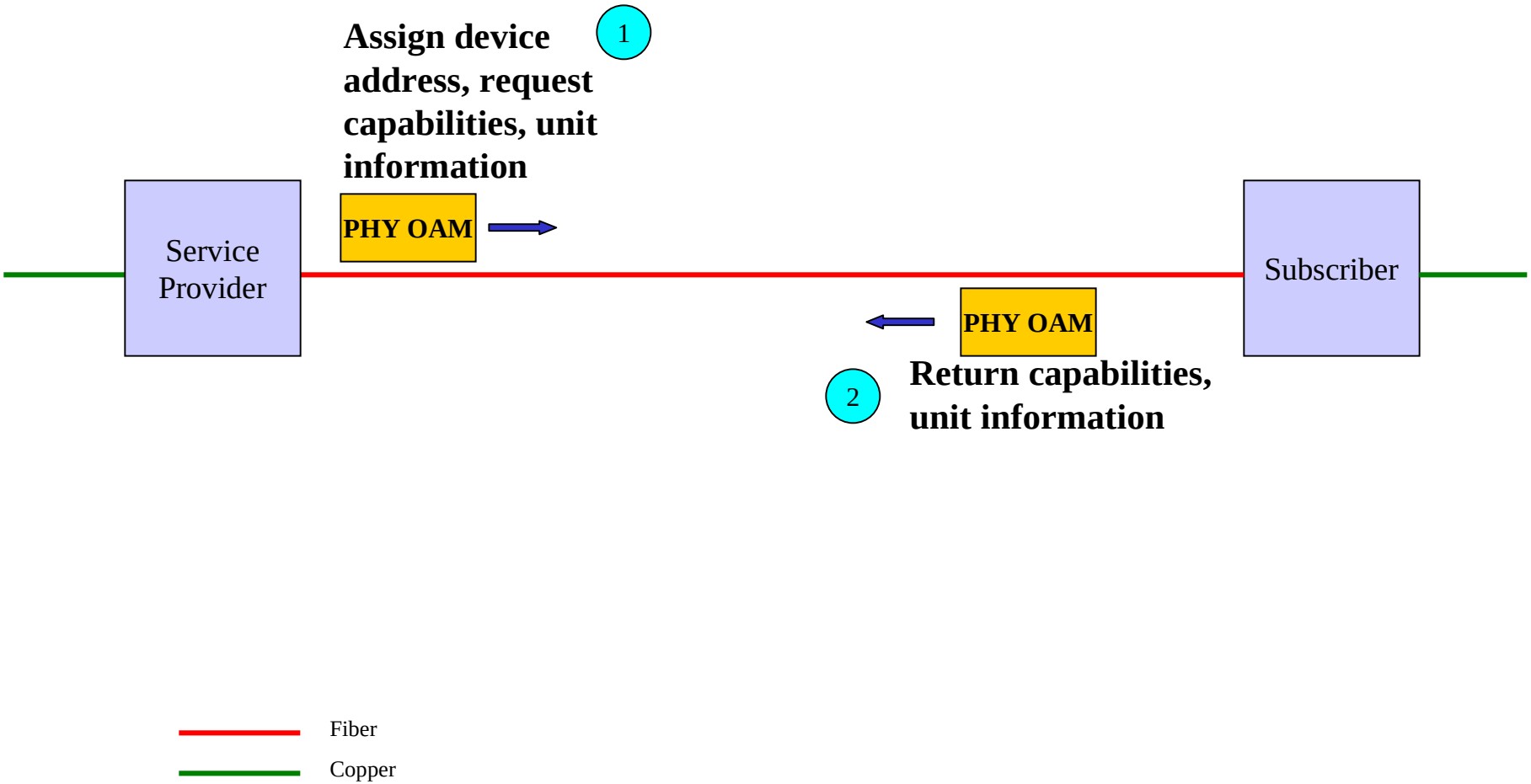


- xDSL copper physical devices easily multiplex on the preamble byte
- Data frames include at least one regular preamble byte
- HDLC framing rules apply for both types of frames
- PHY OAM frames are maintained across a mixture of Ethernet and telephony links

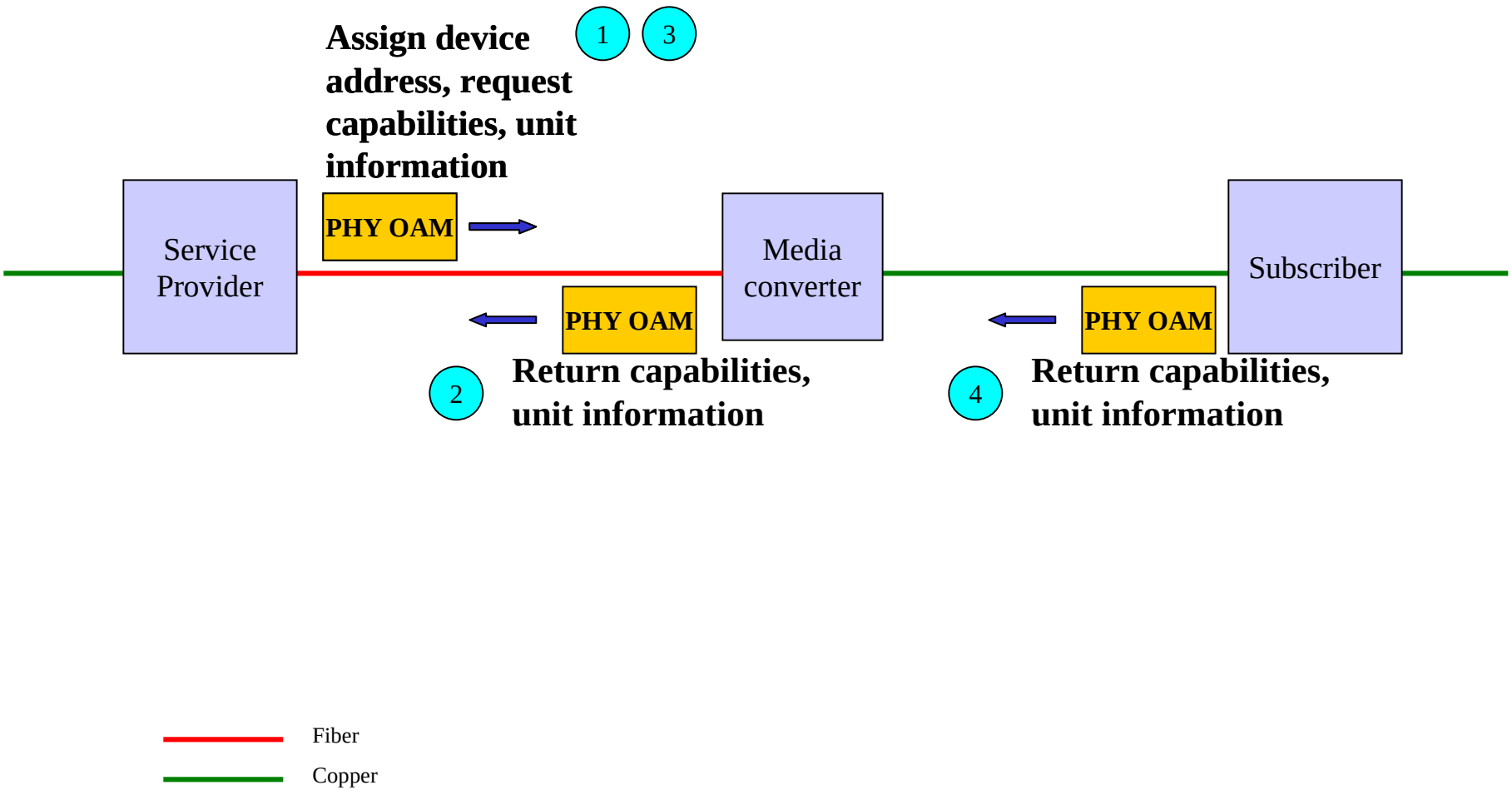
PHY OAM Framing



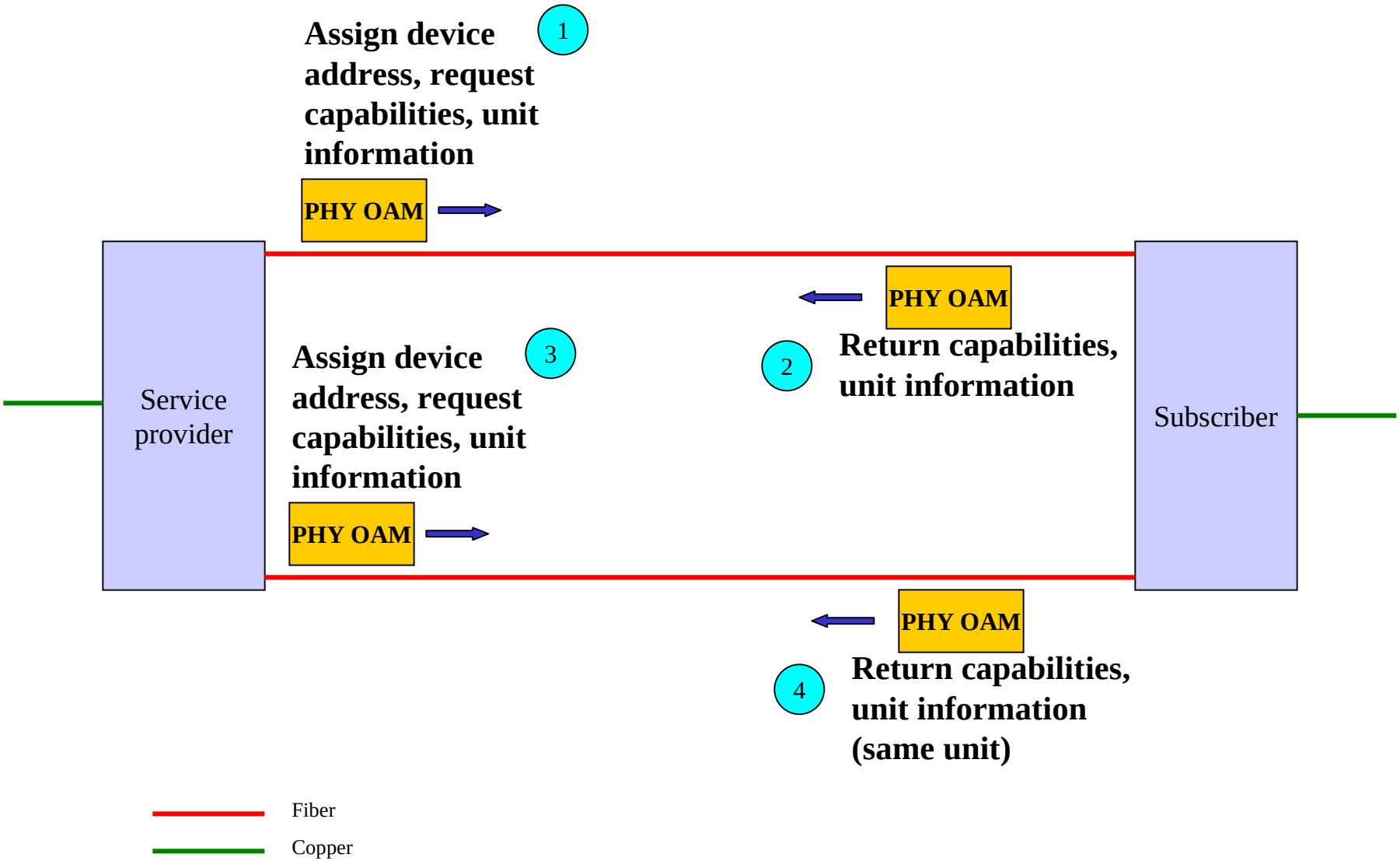
Addressing Methods & Assignment (point to point)



Addressing Methods & Assignment (with intermediate)



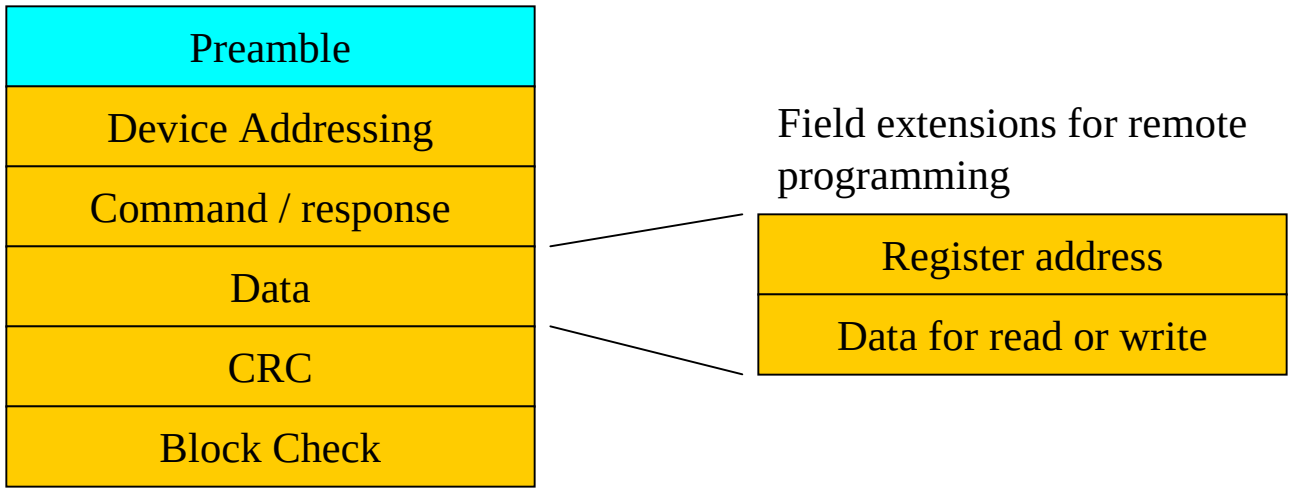
Addressing Methods & Assignment (redundant)



Remote Register Programming

- Register access is defined by capabilities exchanged initially
- Remote programming is available for both MDIO and OAM registers
- Layer 2 and above registers are not accessible as these are available through OAMiF
- Semaphores are used to arbitrate access between remote device and local agent
- The PHY OAM frame contains all the information needed to address, read and/or write the PHY registers if required

Generic PHY OAM frame



OAM Override for Fatal Conditions

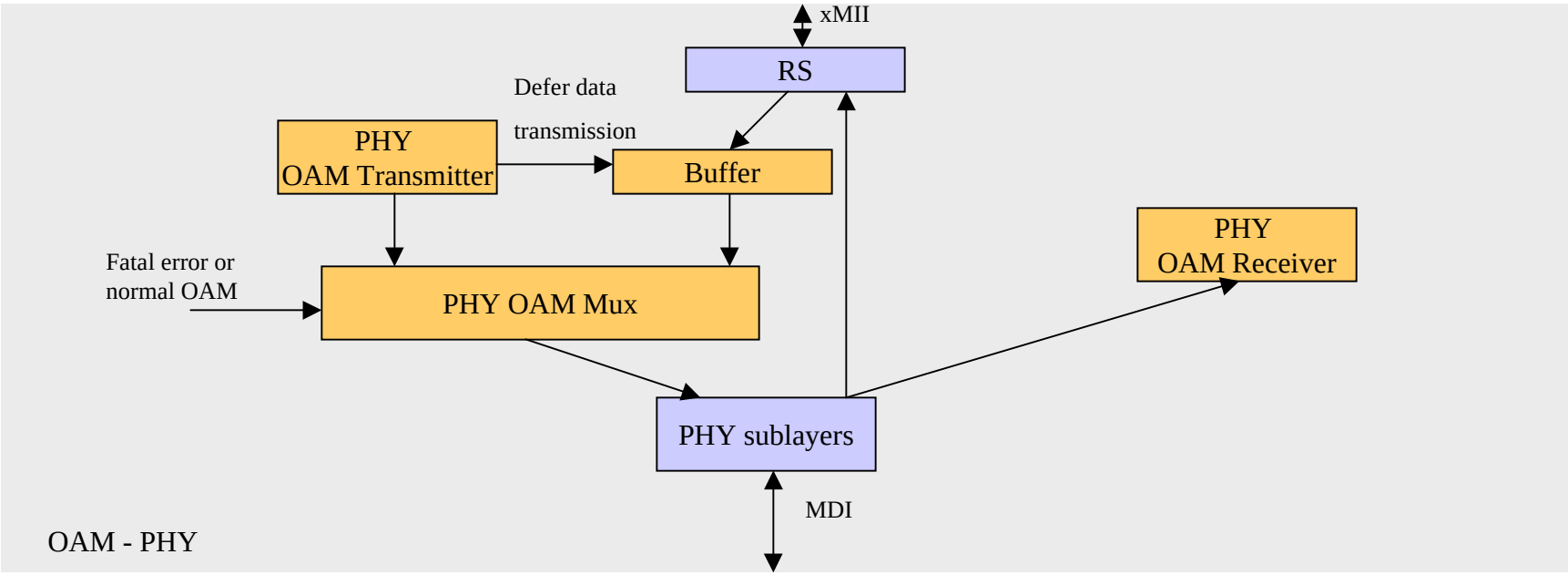
Transmission from MAC or repeated link

Idles	802.3 frame	Idles	802.3 frame	Idles

Transmission from PHY

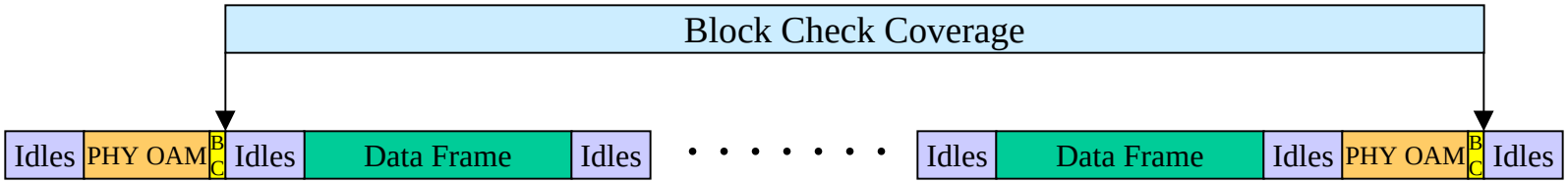
Fatal error occurs - abort data frame

Idles	PHY OAM	Idles	802.3 frame	Idles	802.3 frame (aborted)	Idles	PHY OAM	Idles

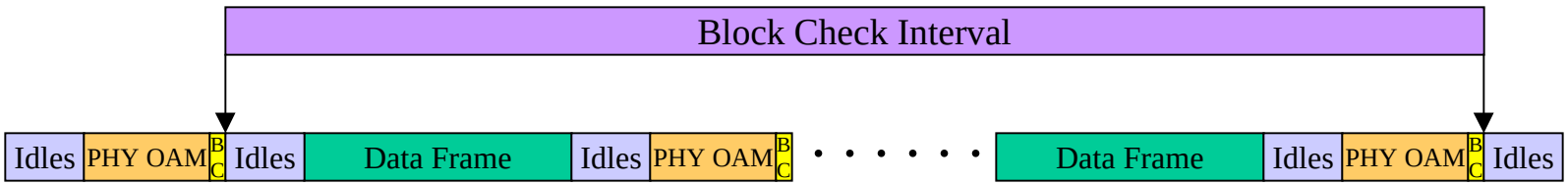


- OAM frames can interrupt data frames to report fatal errors
- Switching occurs below the MAC

Use of Block Checks



- Block check includes all data symbols (non-control) except preamble bytes
- Block check is generated on the transmission side of the link and checked on the receive side of the link



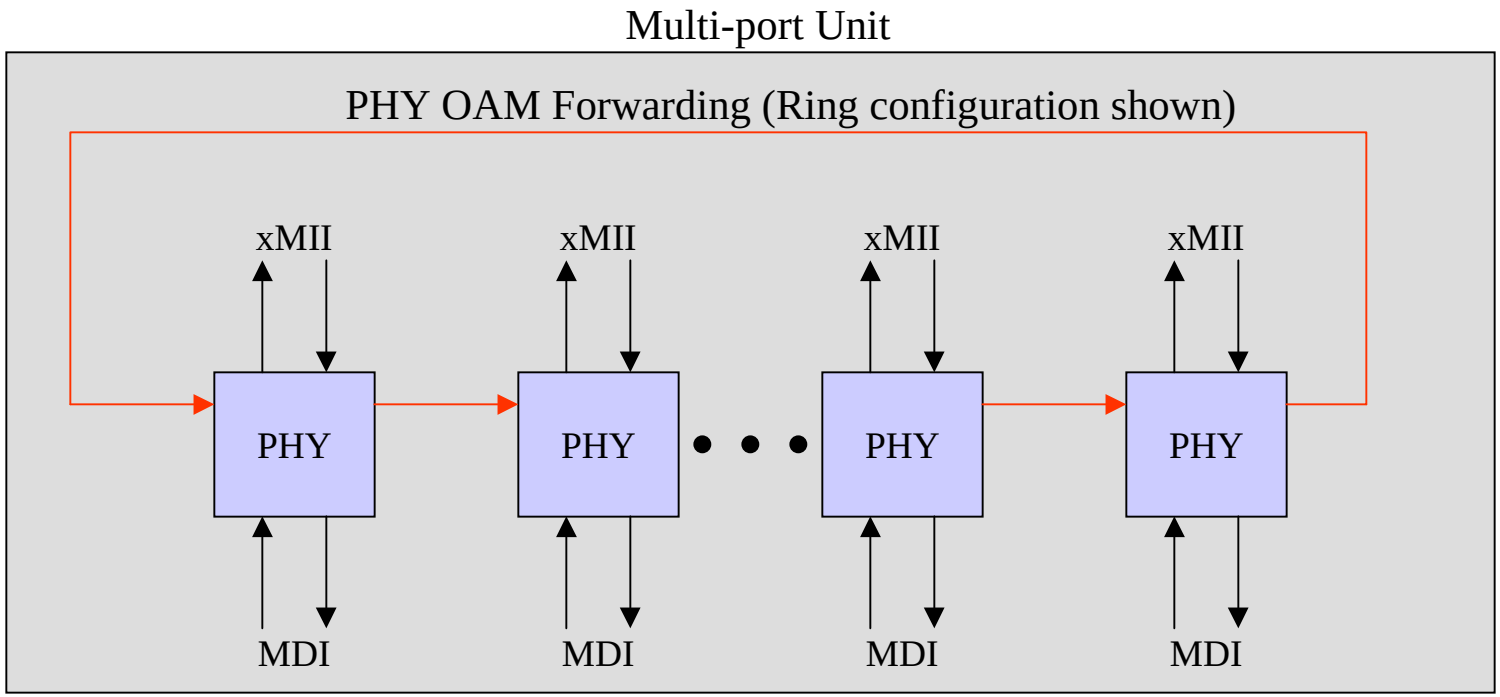
- The Block Check Interval includes a variable amount of Block Checks
- Error counts are accumulated during the Block Check Interval and cleared at the interval boundary
- If Error counts exceed the specified threshold, a link error is reported
- Additional warning thresholds can be established if desired
- On Error counts over the threshold, there is an option to switch to a redundant path

Forwarding PHY OAM Frames

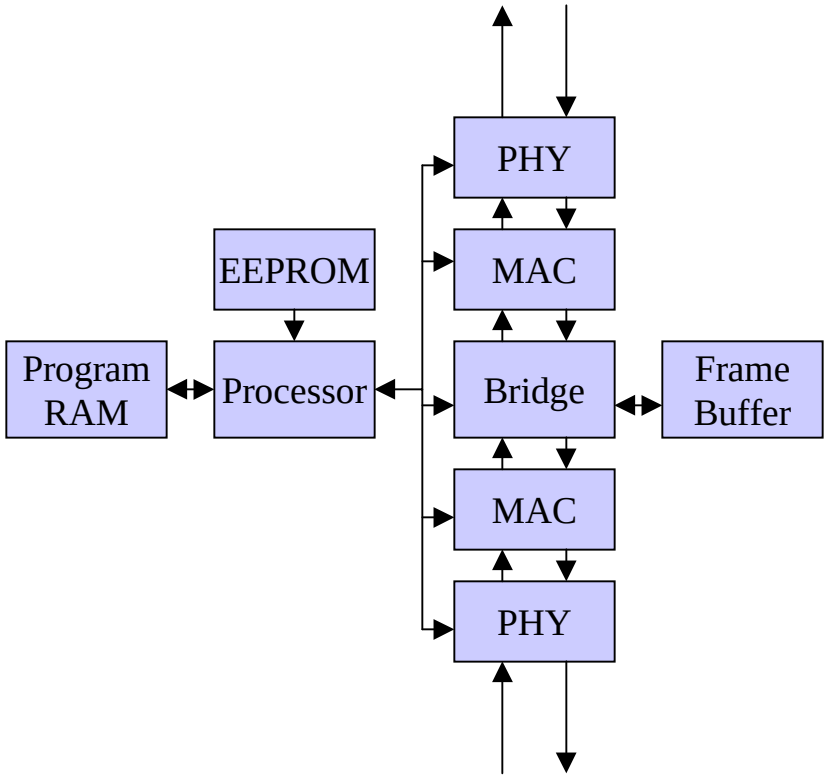
• On multi-link provider networks, OAM will need to be forwarded from the provider end to the subscriber end as well as the reverse path

• A simple physical layer forwarding interface can move PHY OAM frames through complex multi-port devices to provide a complete end-to-end connection

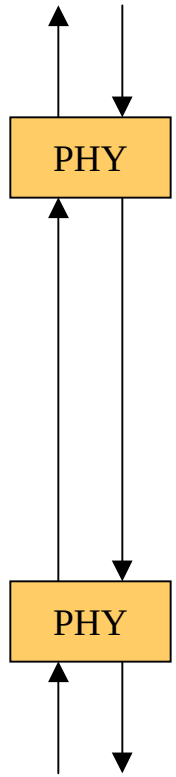
• Standardizing a PHY OAM frame forwarding interface will provide a basis for interoperability



Retimers and Media Converters



Versus



- Some cost sensitive markets will require a less expensive solution
- For “Broad Market Acceptance” a lower cost PHY OAM option should be available
- Potentially, a converter could be required for each subscriber to expose copper to customers

A Complete Management System

- Traditional telephony OAM and Network Management work independently
- We have the opportunity to provide a complete and coordinated management system
- Using a coordinated OAM in frames with PHY OAM to cover low level monitoring, we can a have a complete data and link management system
- Adopting a PHY OAM as a complement to OAM in frames will mean consistent management through all EFM links
- Extensive and flexible management is key to broad market acceptance