Methods and Features of Adding Service Provider OAM Overhead To Existing PCSs

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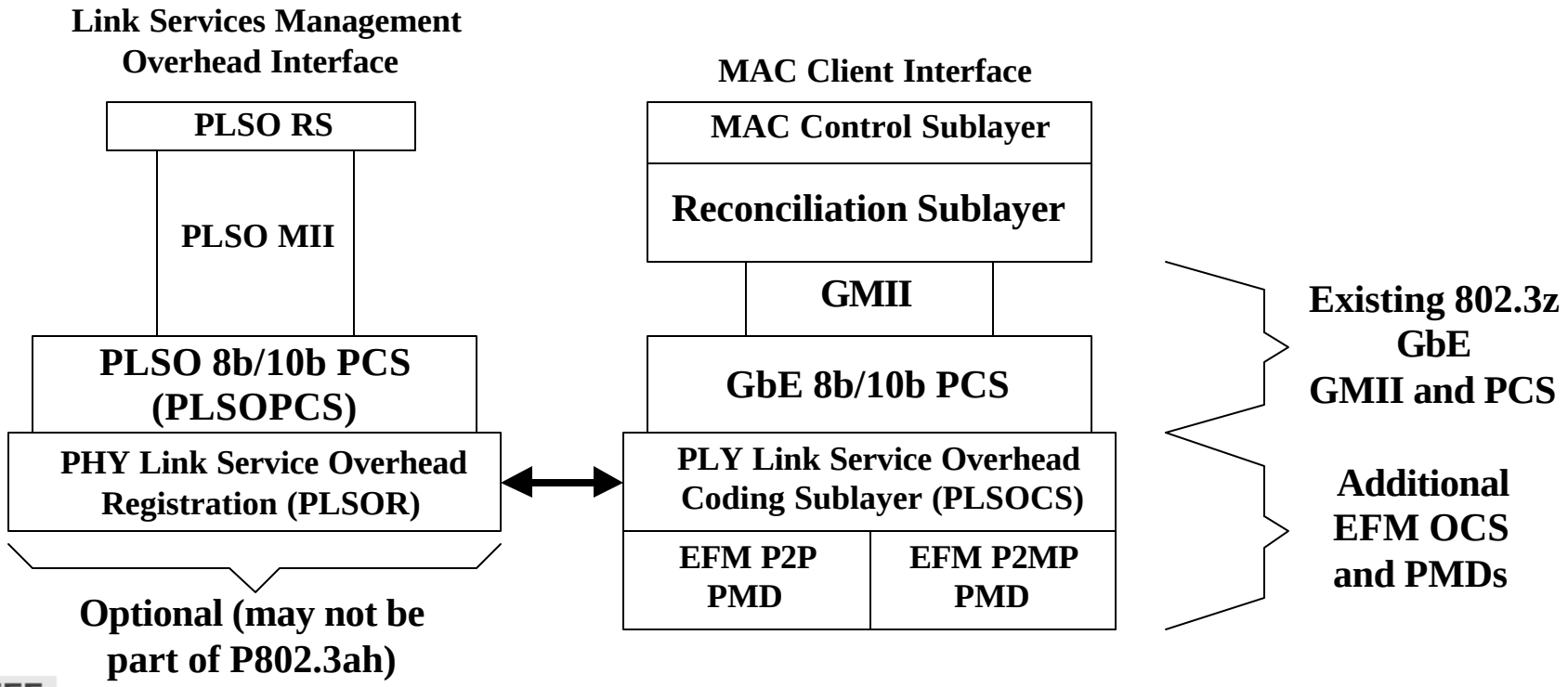
Existing Service Provider Infrastructure Adds OAM Functionality at the Physical Layer

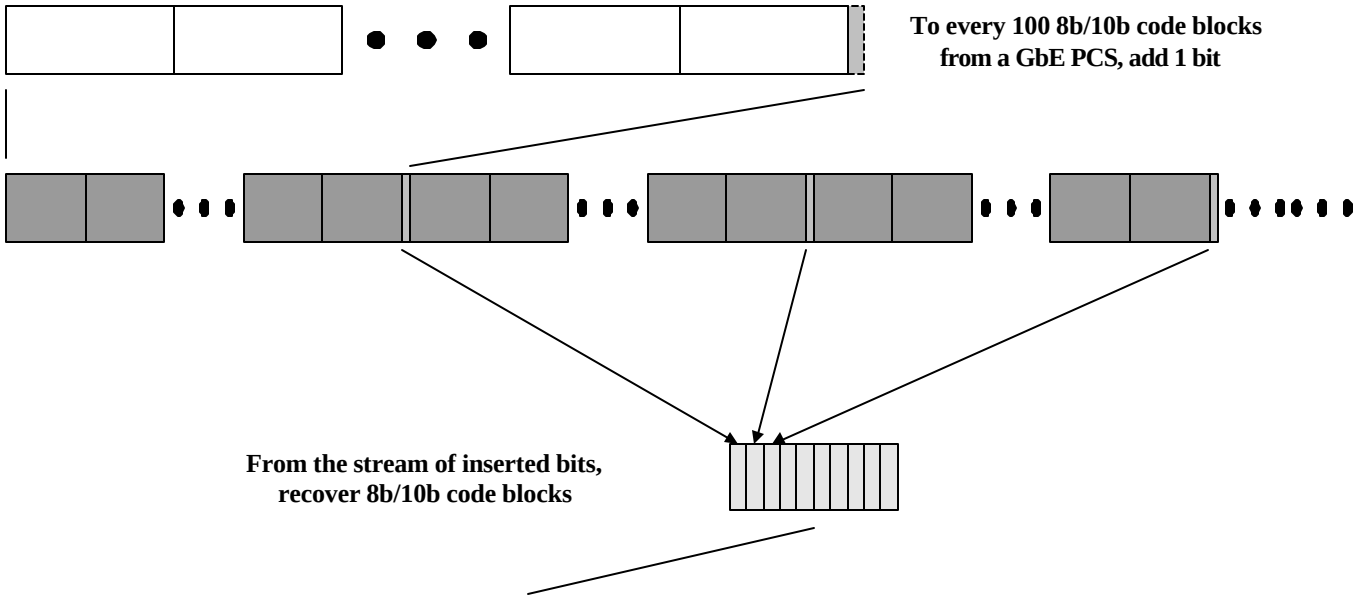
- T1 framing inserts 1 bit of “out of band” overhead for every 192 bits of bearing traffic
- SONET and SDH framing adds “out of band” Payload/Section/Line/Path overhead using a synchronous block frame every 120µs
- Traditional Services are based on Modulo 64 bandwidth rates
- P802.3ah is based on Modulo 10 bandwidth rates

Use Much Of Existing PCS

- Add New Sublayer for Service Provider OAM Overhead – "Physical Link Service Overhead Coding Sublayer" (PLSOCS)



Method 1: Overhead Inserted as Bits Into GbE PCS 8b/10b block Stream



Sync	Sync	DOID/ SOID	ONU Control/ Responce	"Order Wire"
Comm Channel	Comm Channel	Comm Channel	Comm Channel	Comm Channel
Comm Channel	Comm Channel	Comm Channel	Comm Channel	Comm Channel
Remote BER	Remote FER	BIP1	BIP2	BIP3
Data FEC?	Data FEC?	Data FEC?	Data FEC?	OH CRC/FEC

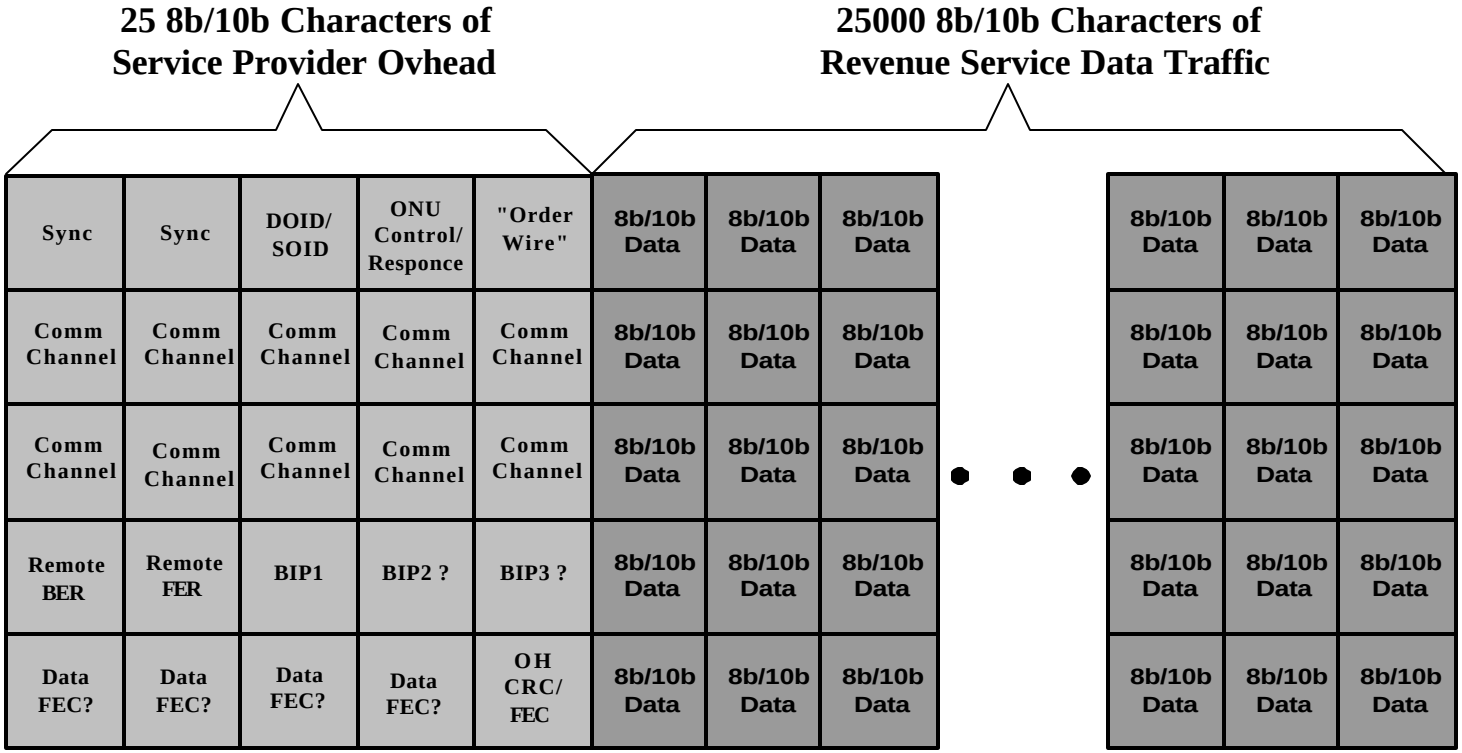
With the stream of recovered 8b/ 10b code blocks form 25 characters of an OAM Overhead blocks

Overhead blocks will repeat every 200us, 5000 times per second

(Character OH fuctions show are representative, not specific)

Method 2: Overhead Inserted as Synchronous Framing of GbE Steam

A synchronous frame of 25 8b10b blocks can be inserted every 200µs instead of inserting individual bits for every 100 blocks.



Overhead Stream Insertion

- Uses existing GbE PCS as much as possible
- Requires adding a few functions to existing state machines – New state machine for overhead PCS
- Provides fixed bit rate base for performance monitoring
- Does not invade Ethernet service traffic
- Adds 0.1% to signal overhead
- Uses 8b/10b encoding of inserted OH
- Provides 23 octets of usable overhead
- Overhead cycles every 200ìs – 5000/second

Inserted Overhead Usage

- First two overhead characters use reserved FC code frames for frame synchronization
- Other overhead characters are used as encoded OAM data octets
- Overhead needs to have a few octet locations defined for common usage regardless of service
- Other octet locations can be service/vendor specific as defined by P802.3ah

EFM OAM Is At The Edge Of The Service Provider Infrastructure

- Each EFM Deployment is an isolated infrastructure.
- “Head-end” system (OLT) will always be the default Send/Receive Node for the “CPE” “tail-end”/ONU systems.
- Only the “tail-end”/ONU systems need to be identified for OAM and service demark/management purposes.
- “Head-end”/OLT system does not need an “address”.
- ONU does not need full Destination/Source “address” to isolate and identify each individual “tail-end”/ONU systems.
- Numbers of supported “tail-end”/ONU systems in each deployment infrastructure is small compared to globally unique 802.3 address space.

EFM OAM Should Not Need To Use 802.3 MAC Address

Physical Level
Light Weight Addressing

- Needs to function below MAC level, primarily only at the Physical level.
- Only the “tail-end”/ONU systems need an “address” for identity within a specific deployment infrastructure.
- Need to have reserved “group” “address” to provide for common/shared service functions.
- Need to have a reserved “broadcast” “address” to provide for service management functions that are “global” within a specific deployment infrastructure.
- Needs to work for Cu, P2P,P2MP, and Full Duplex Intelligent Regenerator/Repeaters on all PMDs

Physical Level Light Weight Addressing Operations Identifier (OID)

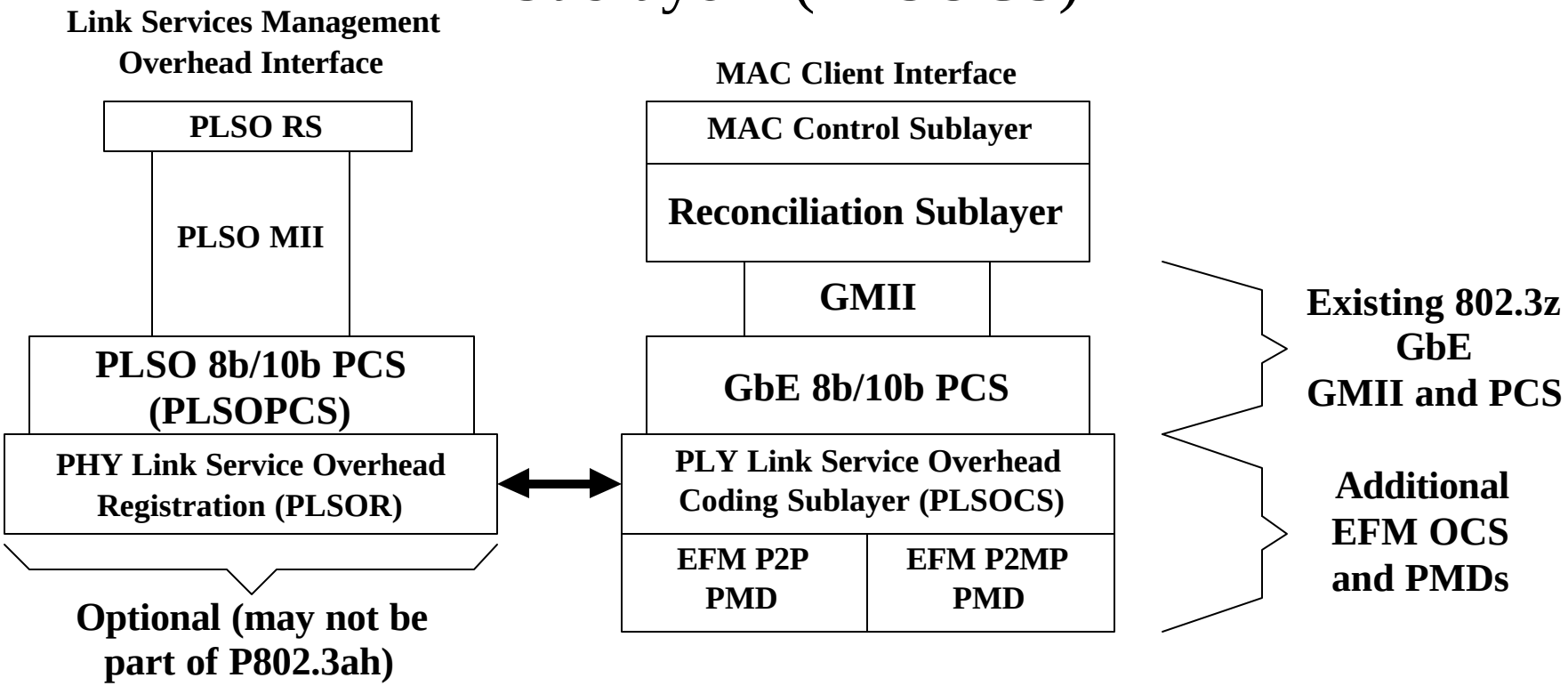
- Single Octet of Address Space (256 addresses).
- Reserve “0” for default address of the “Head-end”/OLT system
- Reserve “255” (“all ones”) for global broadcast address for all “Tail-end”/ONU systems
- Reserve ~”201-224” addresses to “group” services and service functions
- 200 “Tail-end”/ONU addresses available per deployment infrastructure off of each “Head-end”/OLT “interface”

Physical Level
Light Weight Addressing

- The Operations Identifier OID is always that of a “Tail-end”/ONU system OAM “interface”
- If the “Head-end/OLT system is transmitting, the address is the destination “Tail-end”/ONU (DOID)
- If a “Tail-end”/ONU system is transmitting, the address is the source “Tail-end”/ONU (SOID)

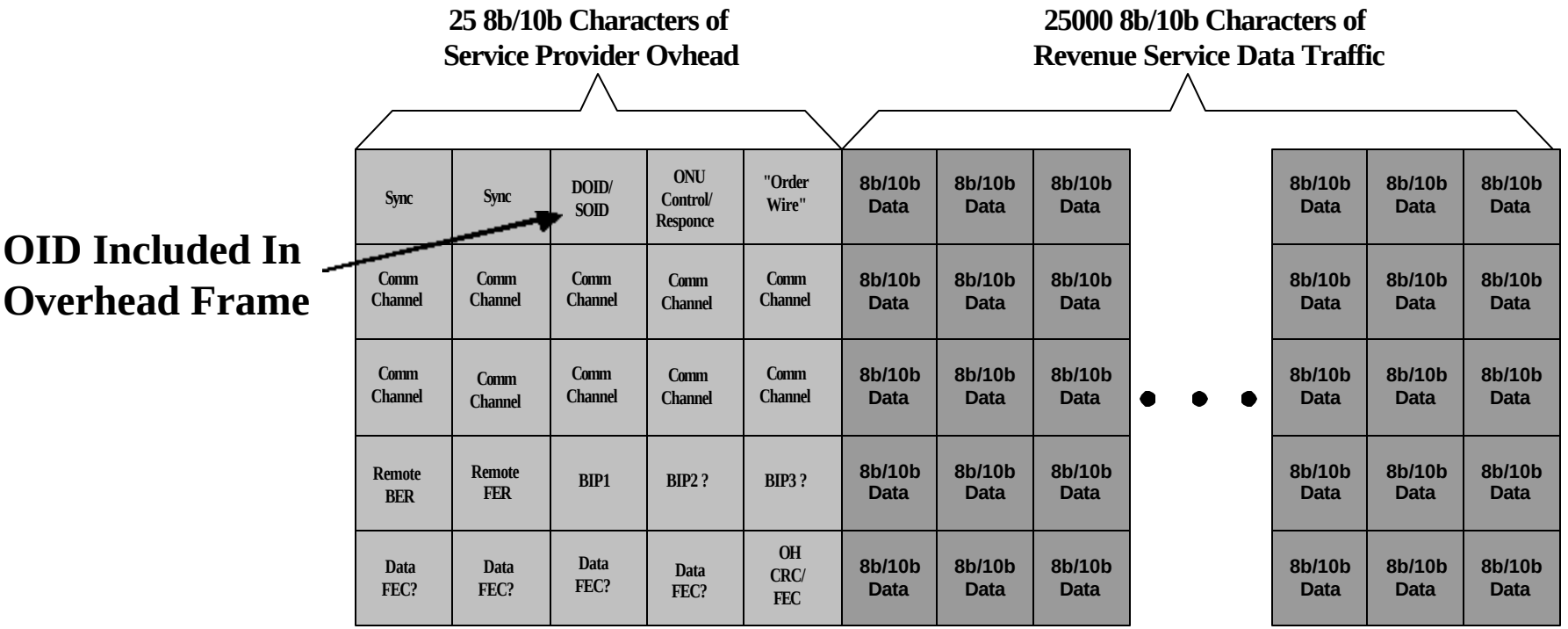
Physical Level Light Weight Addressin Can Operate Below The Existing GbE

Is used in the “Physical Link Service Overhead Coding Sublayer” (PLSOCS)

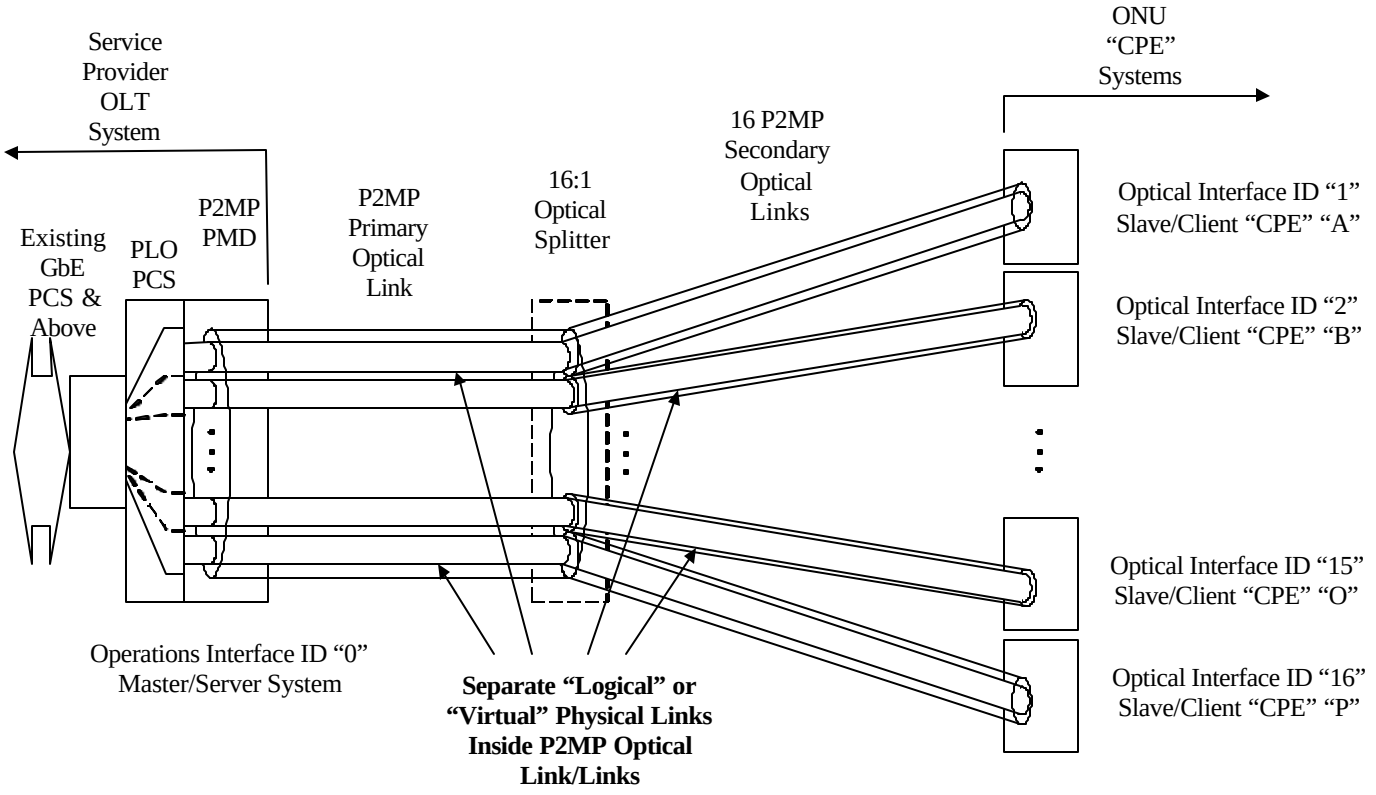


OID in PLSOCS Overhead Inserted as Synchronous Framing of GbE Steam

A synchronous frame of 25 8b10b blocks inserted every 200µs into GbE 8b10b Coded Data Stream



PHY Light Weight Addressing Can Support P2MP Infrastructure



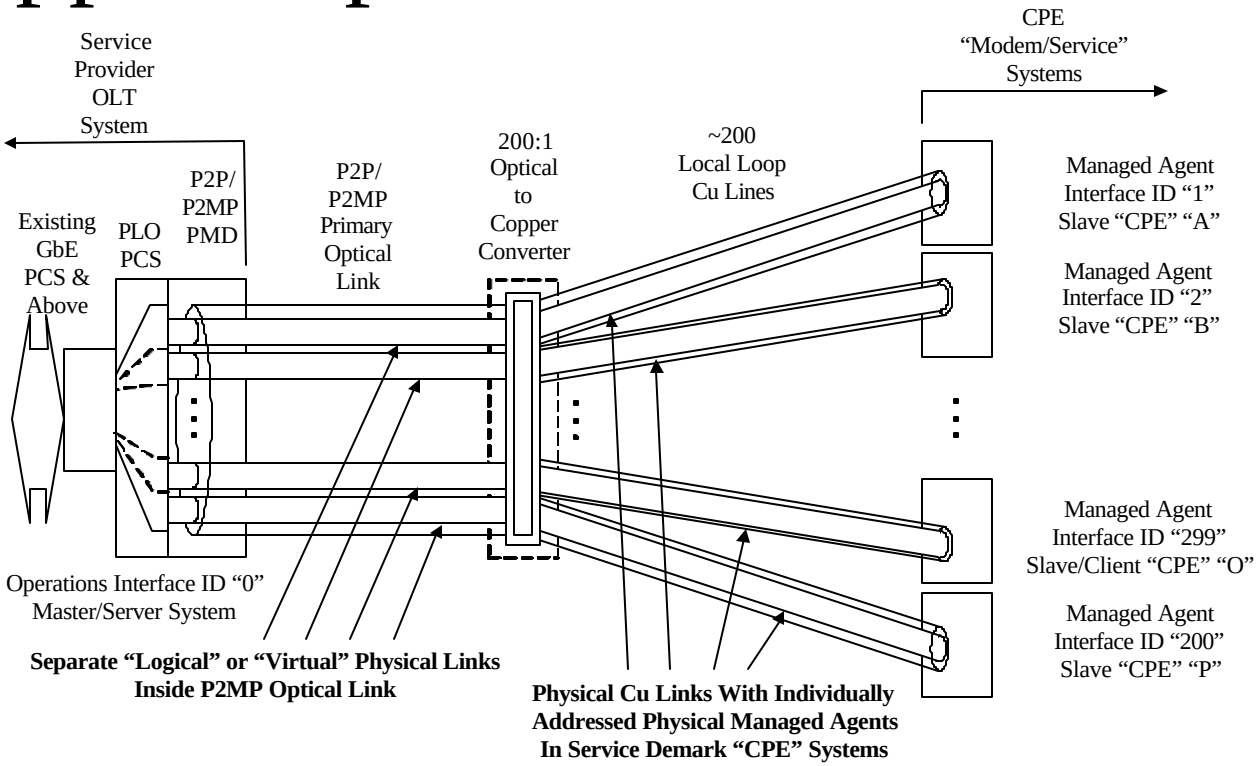
Physical Node Light Weight Addressing
Uses A Single Octet For Source/Destination Address Of ONU
OLT Address Is Default Receive/Send System

OAM Overhead → ONU Destination Operations ID (DOID)

OAM Overhead ← ONU Source Operations ID (SOID)

Source and Destination Operations Interface IDs (Using The SOID/DOID Field) Within The OAM Overhead Provides For Secure Communications For Services and Management Over P2MP Optical Deployments

PHY Light Weight Addressing Can Support Optical to CU Infrastructure



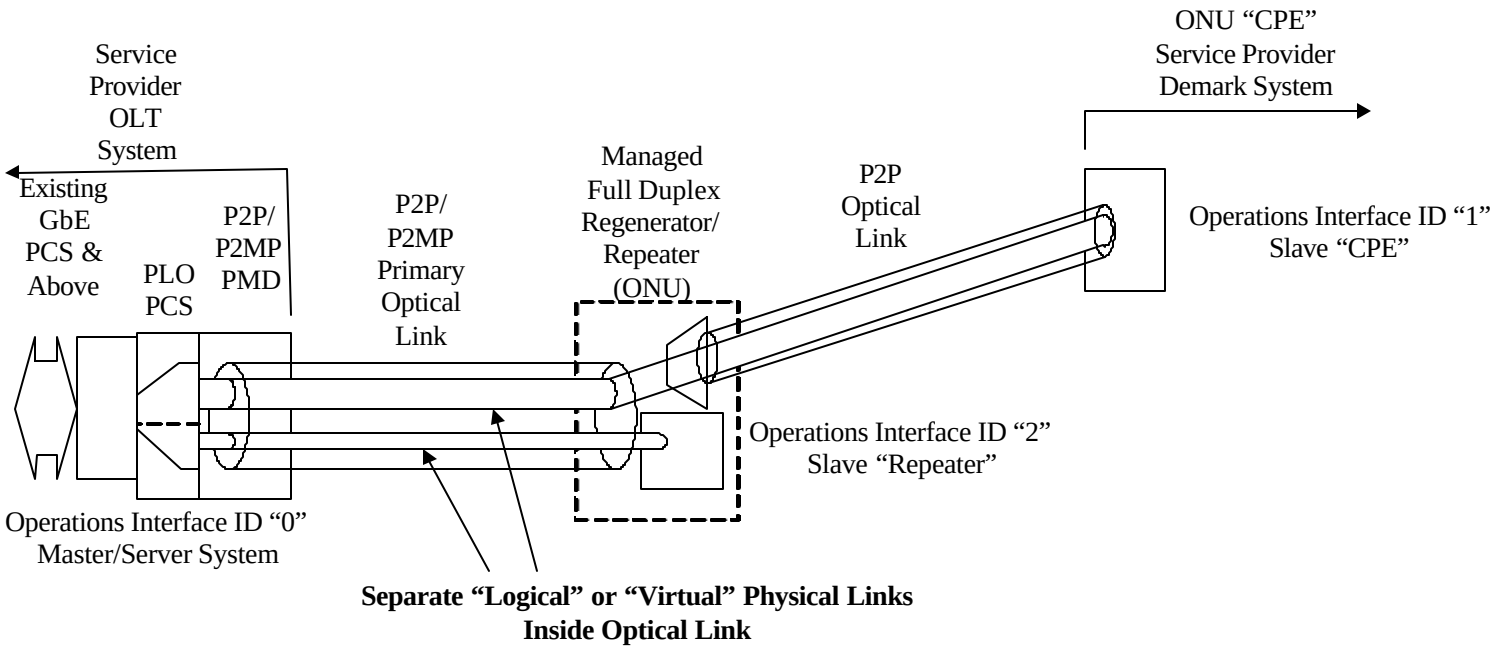
Physical Node Light Weight Addressing
Uses A Single Octet For Source/Destination Address Of "CPE"
OLT Address Is Default Receive/Send System

OAM Overhead → Destination Operations ID (DOID)

OAM Overhead ← Source Operations ID (SOID)

Source and Destination Operations Interface IDs (Using The SOID/DOID Field) Within The OAM Overhead Provides For Secure Communications For Services and Management Over P2MP Optical/Copper Deployments

PHY Light Weight Addressing Can Support P2P Regen/Repeaters



Physical Node Light Weight Addressing
Uses A Single Octet For Source/Destination Address Of ONU
OLT Address Is Default Receive/Send System

OAM Overhead → ONU Destination Operations ID (DOID)

OAM Overhead ← ONU Source Operations ID (SOID)

Source and Destination Operations Interface IDs (Using The SOID/DOID Field) Within The OAM Overhead Provides For Secure Communications For Services and Management Of Repeaters Over P2P Optical Deployments

PHY Light Weight Addressing Is The Most Reasonable Way to Support EFM "Tail-end"/ONU OAM

- Simple, low overhead of a single octet
- More than enough address for P2MP optical
- Reasonable number of address for Cu LL
- Support of intermediate "Repeaters"
- Minimal impact for single P2P deployments
- Able to address multiple OAM interfaces per services demark/node without using up 802.3 addresses

PHY Layer Overhead Provides Required Functionality For Diversity of Services

- Follows existing paradigm of “out of band to revenue traffic” for service OAM overhead
- Adds link level channel for management of upper layer services transparent to the services
- Provides customer transparent control of “slave” CPE system and service demarcation
- Provides for remote troubleshooting functionality without interference to upper layers