

Enabling 100G Transport (PHY Layer OAM Objective)

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HUAWEI TECHNOLOGIES Co., Ltd.

Supporters

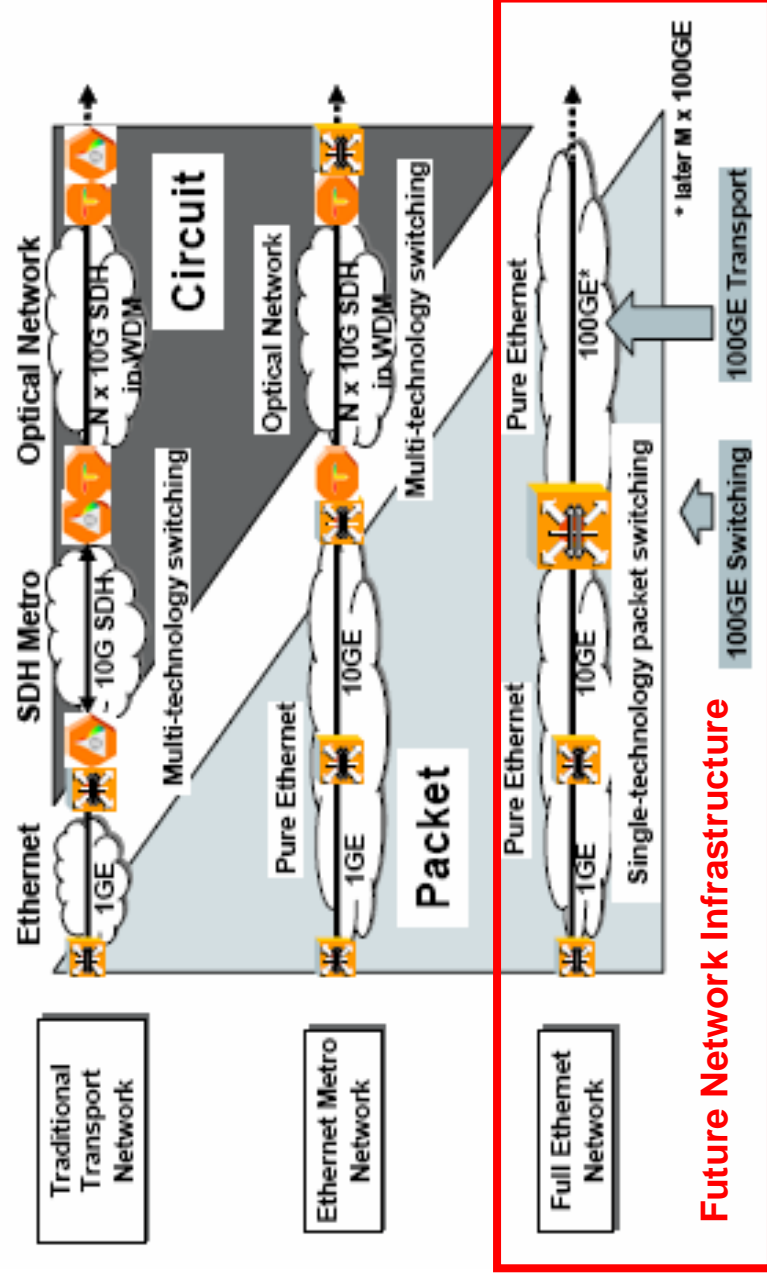
- **Med Belhadj – Cortina Systems**

Ethernet is migrating to Core Transport Applications

100Gb/s makes Ethernet an attractive choice and serious competitor in the backbone networks application

Carriers want Pure Ethernet for future Packet Transport.

100GE should Introduce a PHY layer OAM mechanism to enhance carrier grade features for backbone application.



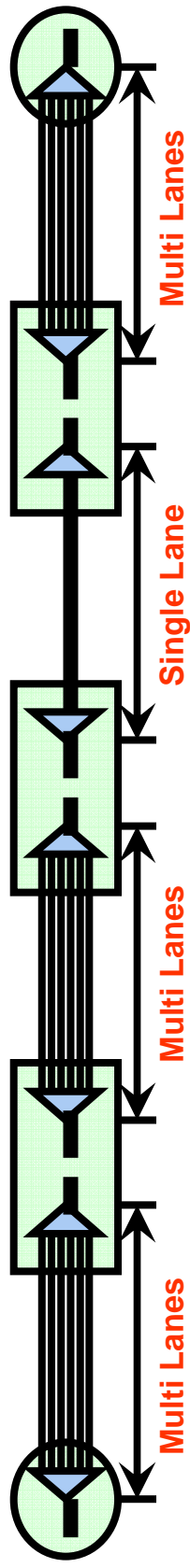
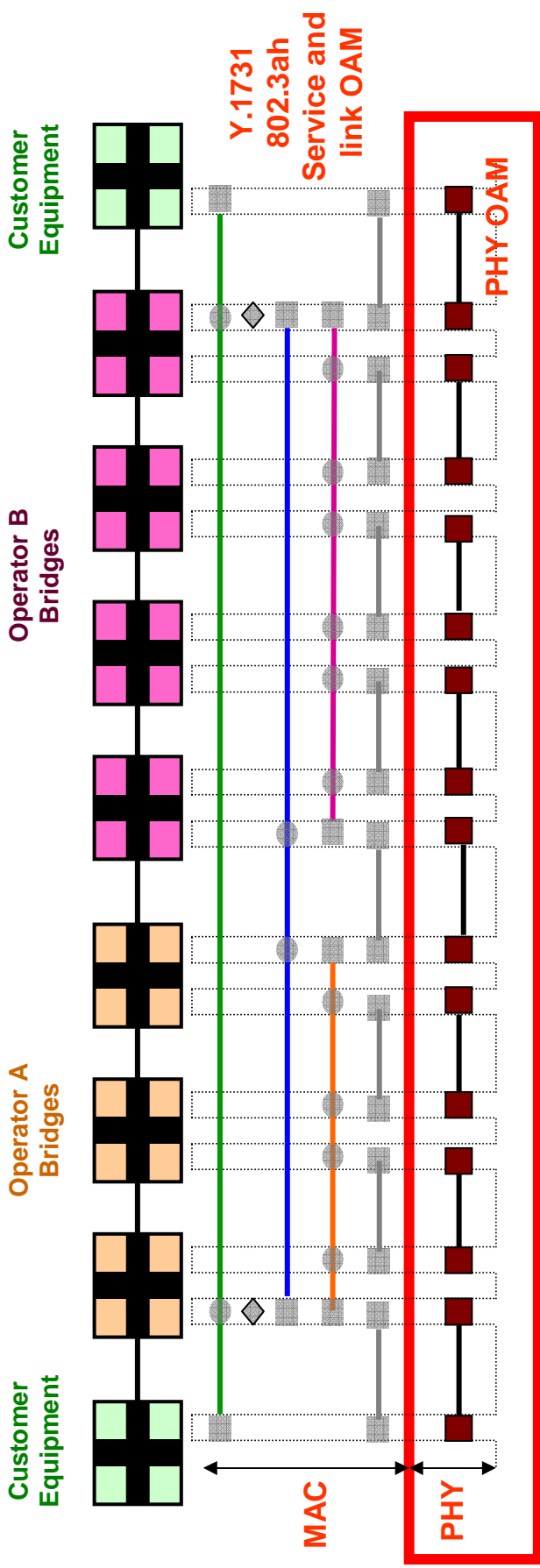
From [1]

- [1] C. Schubert, R. H. Derksen, M. Möller, R. Ludwig, C. -J. Weiske, J. Lutz, S. Ferber, A. Kirstädter, G. Lehmann, and C. Schmidt-Langhorst, "Integrated 100-Gb/s ETDM Receiver," J. Lightwave Technol. 25, 122-130 (2007)
- [2] A. Schmid-Egger, A. Kirstädter, "Ethernet in Core Networks: A Technical and Economical Analysis", Proc. HPSR2006, Poznan, Poland, June 2006.
- [3] G. Lehmann, A. Autenrieth, R. H. Derksen, P. Leisching; „Die neue Ethernet-Generation: 100-Gigabit-Ethernet mit integrierten elektrischen Hochgeschwindigkeitsschaltkreisen“ (Next Ethernet Generation), Photonik 3/2006, pp. 72-75.

Why do we need PHY layer OAM?

- Y.1731 and 802.1ag, 802.3ah Ethernet Service OAM and Link OAM.
 - In band OAM (above MAC layer); occupies service bandwidth, reduces client throughput
 - Link OAM requires deep packet inspection to detect the OAM Message
 - **Link OAM can measure packet loss but is not good for measuring BER or gathering other statistics**
- 100G Ethernet Transport application needs PHY OAM
 - **Only PHY OAM can do true performance monitoring (BER monitoring)**
 - Easy capture and analysis, no deep packet inspection; especially when used for future packet transport network in the core
 - **Enables capability similar to Section/Line in SDH (vs. Path): statistics, fault isolation, etc**
- Multi-lane 100G Ethernet Packet transport needs PHY OAM.
 - Multi-lane de-skew fail fault, Link Partial (Lane) Fault detection and notification; Fast protection switching
 - Possibility for resiliency/self-recovery at a reduced rate when partial lane faults occur; scalable MAC data rate at lane rate granularity

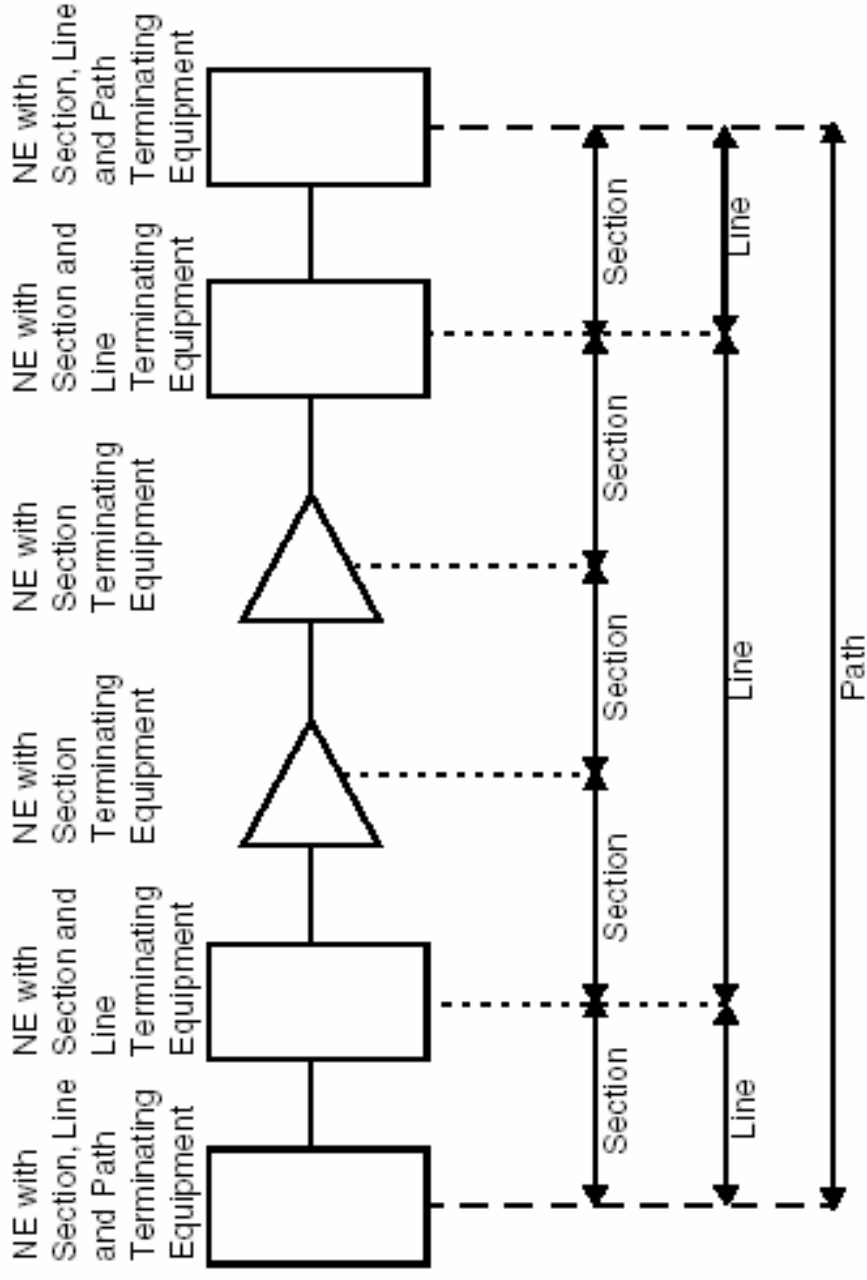
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100GE PHY

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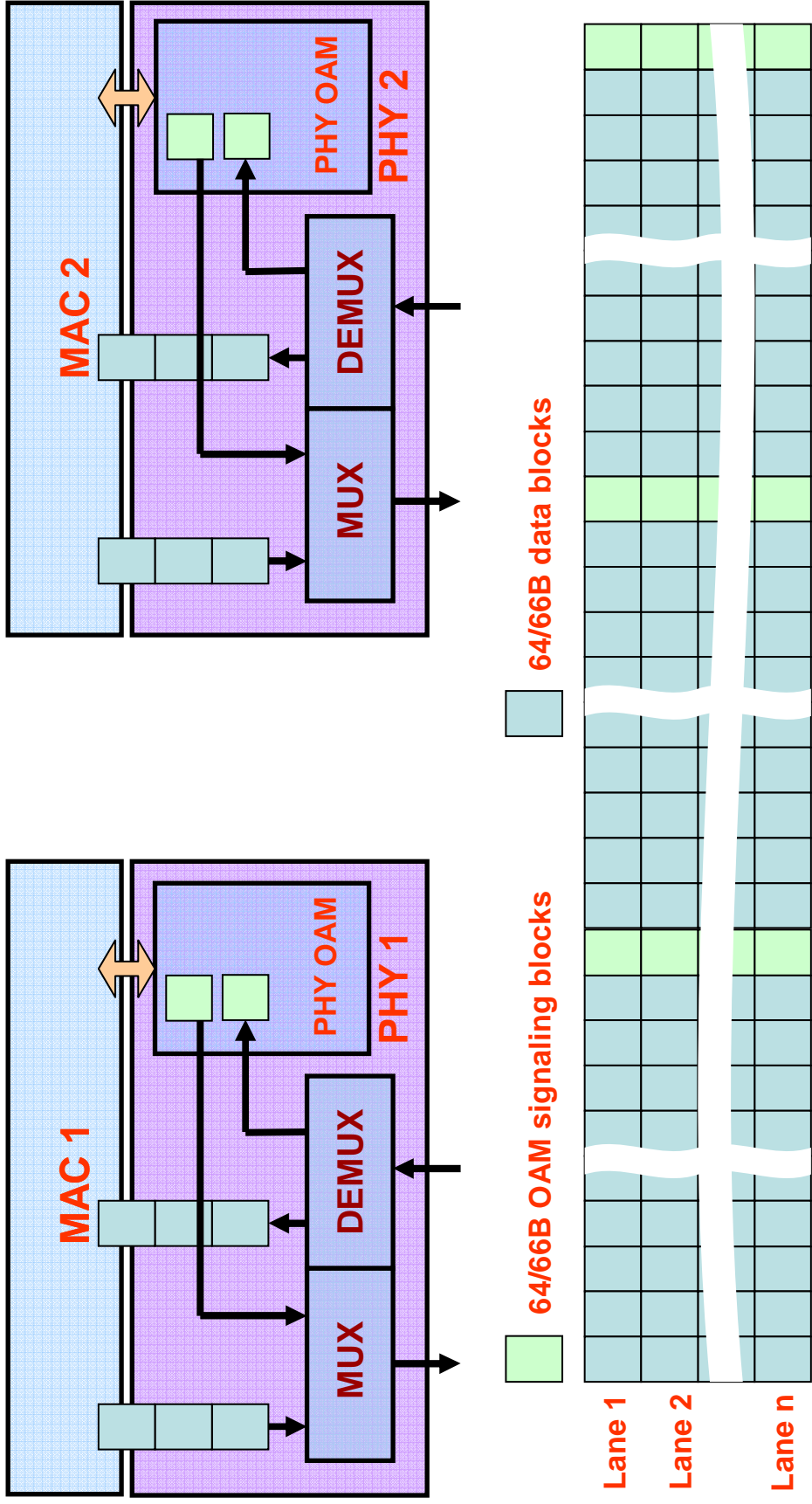
Analogous SONET/SDH Section/Line/Path hierarchy:



How could you implement PHY layer OAM?

- **Migrating the Link Fault Signaling to PHY OAM signaling**
 - Link fault signaling has been used for PHY Fault management, we could introduce a PHY layer signaling for PHY OAM.
 - For single lane or Multi-lane PHYs, may need OAM per lane and whole PHY (AIS\RD\IBER Monitor\Like LCAS...).
- **PHY layer Out-of-band OAM information overhead**
 - Transparent to MAC operation
 - Periodically insert a 64b/66b OAM overhead block on a per-lane basis; increase the PHY bit rate by an incremental amount or de-rate the PHY capacity
 - Use the same method as proposed for the Multi-lane Alignment Control word? (gustlin_01_0107)

How could you implement PHY layer OAM?



Alignment Proposal

- Send alignment on a fixed time basis
- Alignment word also identifies virtual lanes
- Sent every 16k 66bit blocks (104.8usec) on each virtual lane
 - Limits max skew, could also make it programmable
- It interrupts packets
- Takes only 0.006% (61PPM) of the Bandwidth (for 10 virtual lanes, scales linearly for more virtual lanes)
- Rate Adjust FIFO will delete enough IPG so that the MAC still runs at 100.000G with the CTBI at 10.3125G

gustlin_01_0107

Benefits of PHY layer OAM

- **The features and capability to perform Link performance monitoring at line rates to meet Carrier-grade requirements**
- **Enhances 100G with more carrier-grade features; makes Ethernet more suitable for packet core network applications → enables a broader market potential for 100GE!**
- **Can support partial fault resiliency similar to SDH LCAS. Can support the negotiation of a scalable, adaptive MAC data rate at lane rate granularity.**

PHY Layer OAM 5 criteria

- **Compatibility**
 - PHY Layer OAM will not introduce MAC Layer Compatibility Issues
- **Distinct Identity**
 - Compare with the MAC layer service OAM in the 802.3ah, 802.1ag and Y.1731; adds additional capability not currently available
- **Technical Feasibility**
 - Feasible similar to gustlin_01_0107 alignment proposal
 - Easier technically than line rate packet inspection at intermediate nodes
- **Economic Feasibility**
 - Enables more maintainable networks

Summary

- **We recommend adding this objective to PAR A:**
 - Provide an OAM capability in the PHY Layer.

Thank You

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