

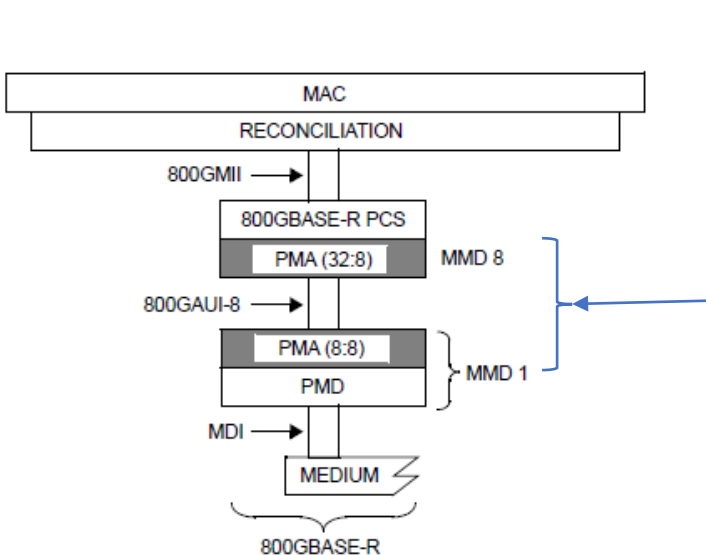
Error budget allocation for 106.25 GBd AUI-C2C and AUI-C2M within a PHY

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Background

- 802.3dj has objectives to define AUIs with 200 Gb/s per lane with similar architectural positioning
 - For example: “**Support optional four-lane 800 Gb/s attachment unit interfaces for chip-to-module and chip-to-chip applications**”.
- Traditionally, Ethernet specifications enabled links with both chip-to-module (C2M) and chip-to-chip (C2C) interfaces within each PHY.
- Errors on AUIs within the PHY are allocated a part of the total FEC error correction capability.
- In May 2023, a DER_0 value of $2.67e-5$ was adopted for the higher-loss AUIs within a PHY
 - See [motion #8 \(ran 3dj 02 2305\)](#)
 - This corresponds to BER of $2e-5$ with uncorrelated errors, or measured BER of $4e-5$ with precoding ON
 - It was noted that **division between C2C and C2M** and measurement method are to be determined
- This presentation addresses division between C2C and C2M.

Possible PHY structures (from 802.3df D2.1)

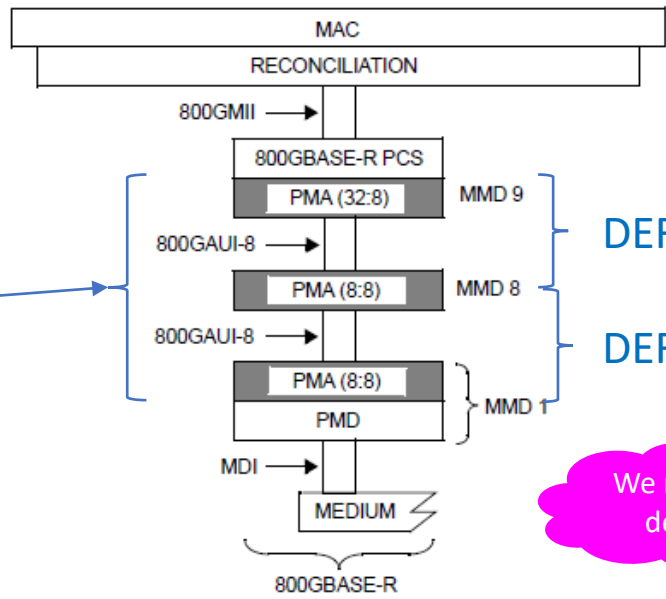


800GAUI = 800 Gb/s ATTACHMENT UNIT INTERFACE
 800GMII = 800 Gb/s MEDIA INDEPENDENT INTERFACE
 MAC = MEDIA ACCESS CONTROL
 MDI = MEDIUM DEPENDENT INTERFACE
 MMD = MDIO MANAGEABLE DEVICE

PCS = PHYSICAL CODING SUBLAYER
 PHY = PHYSICAL LAYER DEVICE
 PMA = PHYSICAL MEDIUM ATTACHMENT
 PMD = PHYSICAL MEDIUM DEPENDENT

Figure 173A-1—Example PMA layering with eight-lane PMD and single 800GAUI-8

The adopted $DER_0 = 2.67e-5$ holds for both cases



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Figure 173A-2—Example PMA layering with eight-lane PMD and two 800GAUI-8

$DER_0 = TBD$

$DER_0 = TBD$

We need to decide

AUIs within an xGMII Extender are not within the PHY – not addressed in this presentation

BER budget division in the existing standard

- In previous projects, the PHY error budget was $2e-5$ (implicitly as measured BER) and was split evenly between C2C and C2M
- As a result, C2M specifications were based on $1e-5$
 - Modules had $BER < 1e-5$ specified for stressed input test with specific test channels
 - Host output specified with EH and VEC with a probability of $1e-5$
 - And similarly in the other direction
- What if a host has only C2M and no C2C?
 - Host output still needs to meet EH and VEC with a probability of $1e-5$ – it does not get a benefit
 - Host stressed input has the same signal, and the requirement is still $BER < 1e-5$ – it does not get a benefit
 - Module specifications do not change

Thoughts

- Many (perhaps most) hosts do not use retimers
 - Effectively the C2C budget is not used
 - For such hosts, having the whole BER budget for C2M would allow more flexibility in channel design
- When C2C is used, it is not a pluggable interface
 - At 106.25 GBd it is likely an engineered link
 - Is it reasonable to expect a much lower BER than C2M?
- The C2C interface can be moved outside of the PHY if the external chip has a PHY XS+PCS
 - In that case it can have a much higher BER
- Can we have different C2M error allocation based on whether C2C is used or not?
 - Error allocation is part of the specifications of both host and module
 - Hosts can choose one specification based on their structure – but modules should work with any kind of host
 - It implies that modules would need to meet two sets of specifications...

Thoughts (cont.)

- Previous C2M specifications did not use COM and had no DER_0
- Previous host/module/“chip” specifications are in terms of measured BER
- In 802.3dj, channel specs and device measurement methods are still TBD
- Error budget allocation in relative terms (or percentage) is still possible
 - This could move us forward!

Possible paths forward

- A. Have different C2M BER allocation based on whether C2C is used or not**
 - Implies two sets of C2M specs for both hosts and modules
- B. Allocate the whole error budget to the C2M**
 - If COM will be used, then $DER_0=2.67e-5$
 - C2C can still be used in an xGMII Extender with a large error budget
- C. Split the error budget evenly between C2M and C2C**
 - If COM will be used for both, then $DER_0=1.33e-5$ for both
- D. Give C2M a larger share**
 - A specific division: 90% for C2M and 10% for C2C
- E. Give C2C a larger share**
 - Does not look interesting

Potential Straw polls

- I would support:
 - A. Different allocation and specs for C2M depending on whether C2C is used
 - B. Fixed allocation for C2M regardless of C2C
 - C. Abstain
- I would support allocating the error budget between two AUIs within a PHY as follows:
 - A. 100% for C2M, 0% for C2C (C2C only possible as part of an xGMII Extender)
 - B. 50% for C2M, 50% for C2C
 - C. 90% for C2M, 10% for C2C (or otherwise larger share for C2M)
 - D. 10% for C2M, 90% for C2C (or otherwise larger share for C2C)
 - E. Need more information
 - F. Abstain