

Proposed Asymmetrical Modulation

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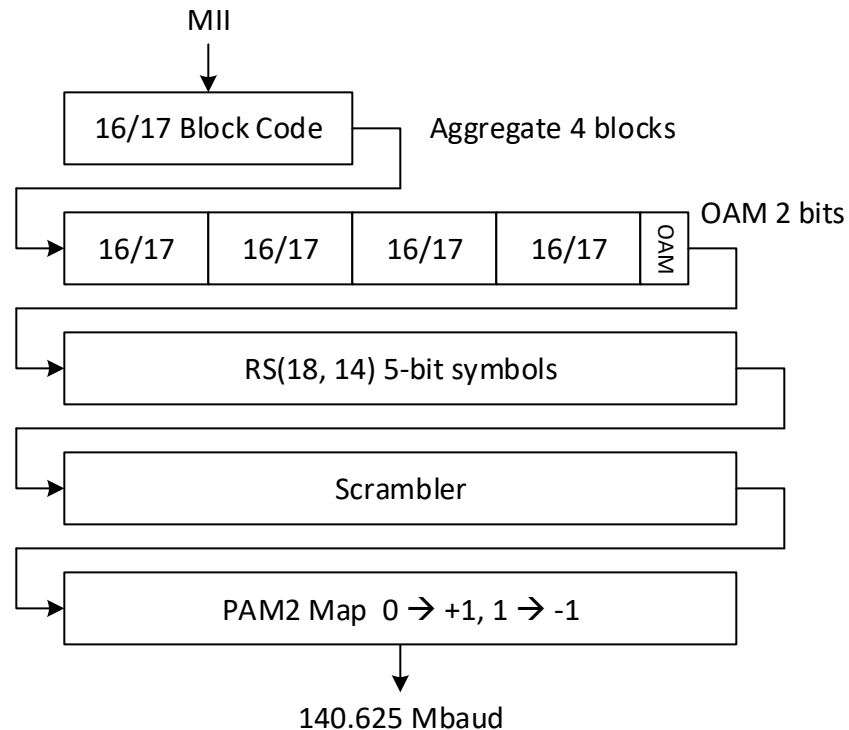
September 18, 2024

Proposed Modulation Based on Analysis of

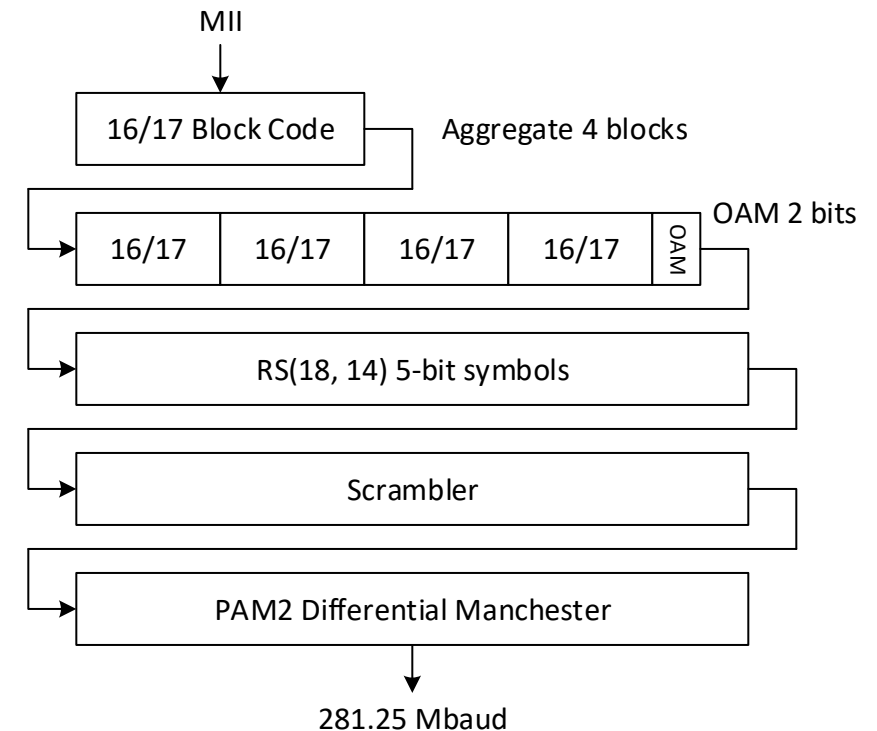
- https://www.ieee802.org/3/dm/public/0724/sedarat_3dm_202407.pdf
- The numbers proposed here differs a little bit but captures the same ideas

Proposed Modulation

- Downstream identical to 802.3ch (10GBASE-T1)
- Upstream similar to work in 802.3dg except in PAM2



or



Latency Considerations and MII Interface

- MII is nibble based. Conventional 64/65 encoder is not well suited for interfaces that are not 4-byte based.
- 802.3bp (1000BASE-T1) uses $8N/(8N+1)$ encoder – Clause 97.3.2.2.5
- 802.3dg (100BASE-T1 long reach) further refined to handle nibbles
 - https://grouper.ieee.org/groups/802/3/dg/public/May_2024/Lo_3dg_01a_0724.pdf
 - Constant latency encoder/decoder - what you see is what you get on MII
 - Supports Sequence Ordered Sets
 - Adopted $8N/(8N+1)$ where $N=2$ for low latency
- Same 16/17 encoder/decoder proposed here

Latency and Error Correction

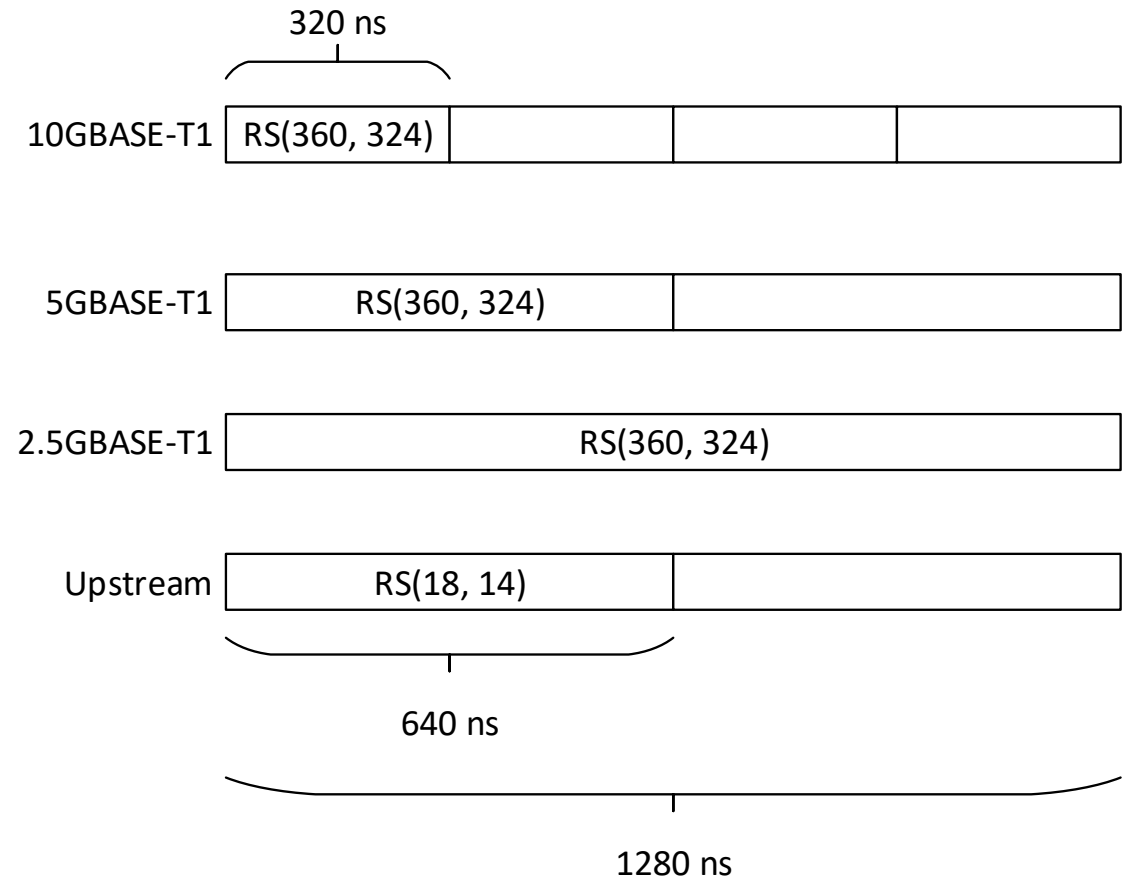
- Minimize bit accumulation required in 100Mbps to minimize latency. Each bit is 10ns.
- Discussion here in 802.3dg
 - https://grouper.ieee.org/groups/802/3/dg/public/May_2022/Lo_3dg_01_011024.pdf
- Short 16/17 encode – accumulate 16 bits to encode
- Short Reed Solomon code – RS(18, 14, GF(2⁵)) – accumulate 64 bits on MII
- Very low complexity Reed Solomon
- Corrects up to 71.1ns burst

Scrambler, PAM, and Line Rate

- Use 802.3ch scrambler – Clause 149.3.4
- Choose one of the following:
- If upstream baud rate is $1/40$ (140.625 Mbaud) of 10GBASE-T1 then
 - Map 0 to +1 and 1 to -1 for PAM2 mapping
- If upstream baud rate is $1/20$ (281.25 Mbaud) of 10GBASE-T1 then
 - Use Differential Manchester Encoding (DME) similar to Clause 147.4.2

Size of RS Frames

- Upstream RS frame chosen to match 802.3ch
- Can use 802.3ch training sequence with modifications to upstream training frame



Summary

- Downstream – Identical to 802.3ch
- Upstream encoder/decoder – Identical to 802.3dg low latency
- RS – low cost RS(18, 14, GF(2⁵))
- Simple PAM2 mapping or DME mapping
- Baud rate 1/40 10GBASE-T1 for simple PAM2 or 1/20 for DME
- Reuse 802.3ch training with small modifications

THANK YOU