Addressing Skew and Skew Variation

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Introduction

- In P802.3cd Draft 1.0 the skew and skew variations for the various sublayers have been left as TBD and were not addressed by accepted comments against D1.1.

- For 50G and 100G, two options are explored taking into consideration that the single-lane PMD and medium contribute no skew or skew variation.

- For 200G, it is proposed that we reuse the numbers for other PMDs specified in P802.3bs.

# Skew and Skew Variation Constraints Introduction

- As it stands, all 50G PMDs and media have a single physical lane. As such, the PMD and medium contribute no Skew or Skew Variation.

  - We might consider adjusting the 50G Skew and Skew variation budget to reflect this.

- Similarly for 100G, the 100GBASE-DR PMD and medium have a single physical lane and contribute no Skew or Skew Variation.

  - We might consider adjusting the 100GBASE-DR PMD Skew and Skew Variation specifications to reflect this.

- For 200G, since all new PMDs are have more than one lane we should stick with the P802.3bs budget.

40G/100GBASE-R Skew constraints per Clause 80

Table 80–6—Summary of Skew constraints

Skew points	Maximum Skew (ns)[a]	Maximum Skew for 40GBASE-R PCS lane (UI)[b]	Maximum Skew for 100GBASE-R PCS lane (UI)[c]	
SP0	29	N/A	≈ 150	See 83.
SP1	29	≈ 299	≈ 150	See 83.
SP2	43	≈ 443	≈ 222	See 83. 87.3.2, 94.3.4,
SP3	54	≈ 557	≈ 278	See 84. 88.3.2, 95.3.2
SP4	134	≈ 1382	≈ 691	See 84. 88.3.2, 95.3.2
SP5	145	≈ 1495	≈ 748	See 84. 88.3.2, 95.3.2
SP6	160	≈ 1649	≈ 824	See 83.
SP7	29	N/A	≈ 150	See 83.
At PCS receive	180	≈ 1856	≈ 928	See 82.
At RS-FEC transmit	49	N/A	≈ 253	See 91.
At RS-FEC receive[e]	180	N/A	≈ 4641	See 91.
At PCS receive (with RS-FEC)	49	N/A	≈ 253	See 82.

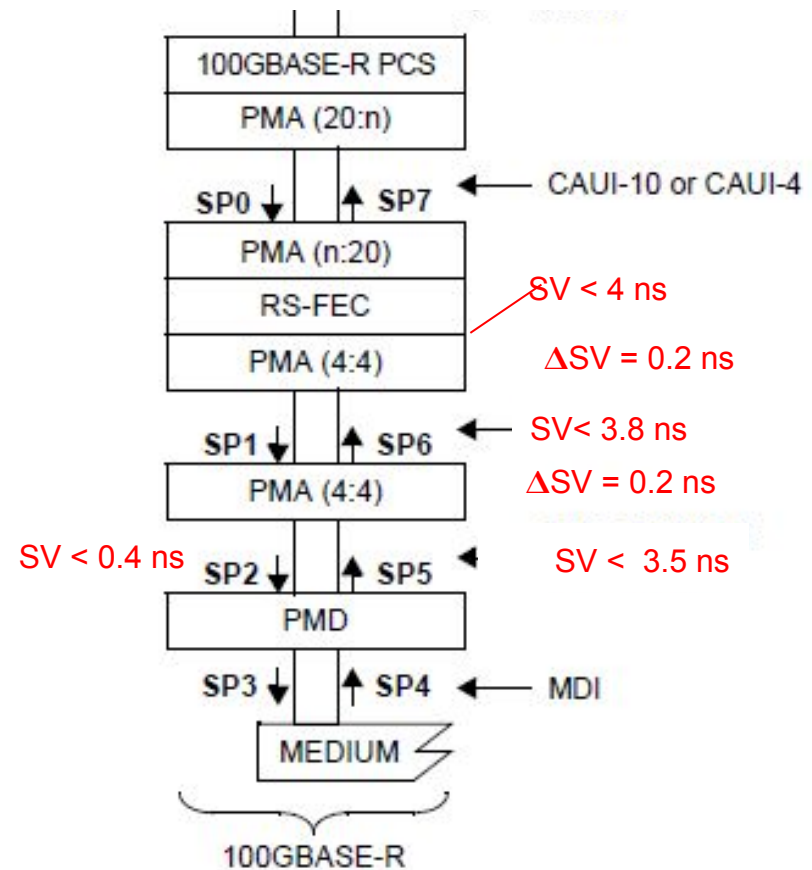This slide maps the Skew budget numbers to the skew points for 40GBASE-R and 100GBASE-R.

4
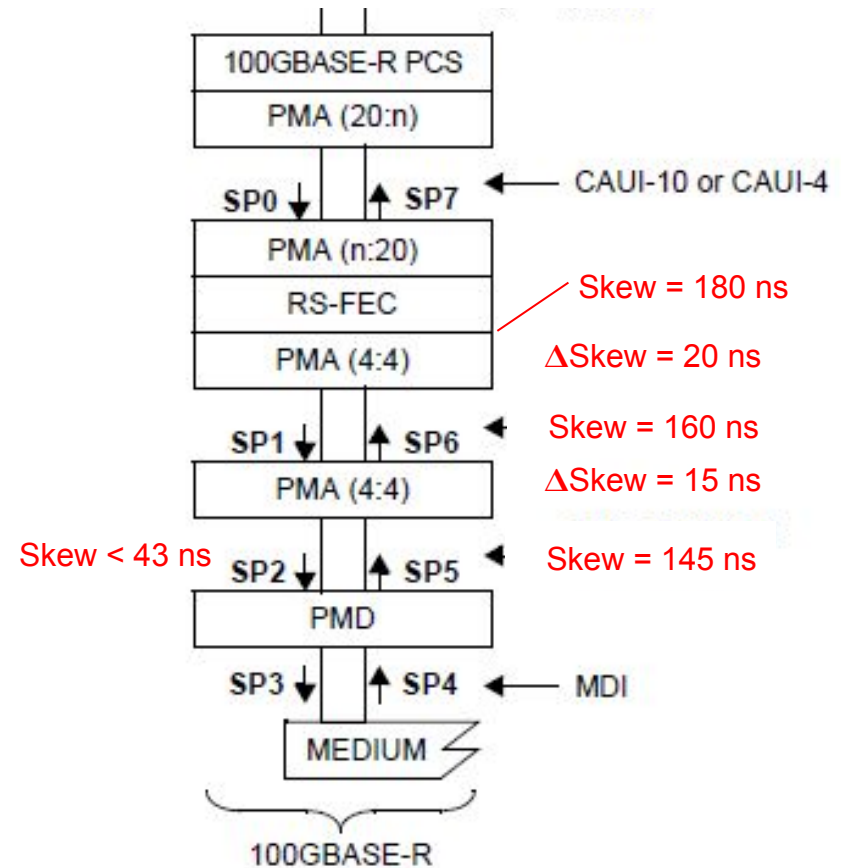
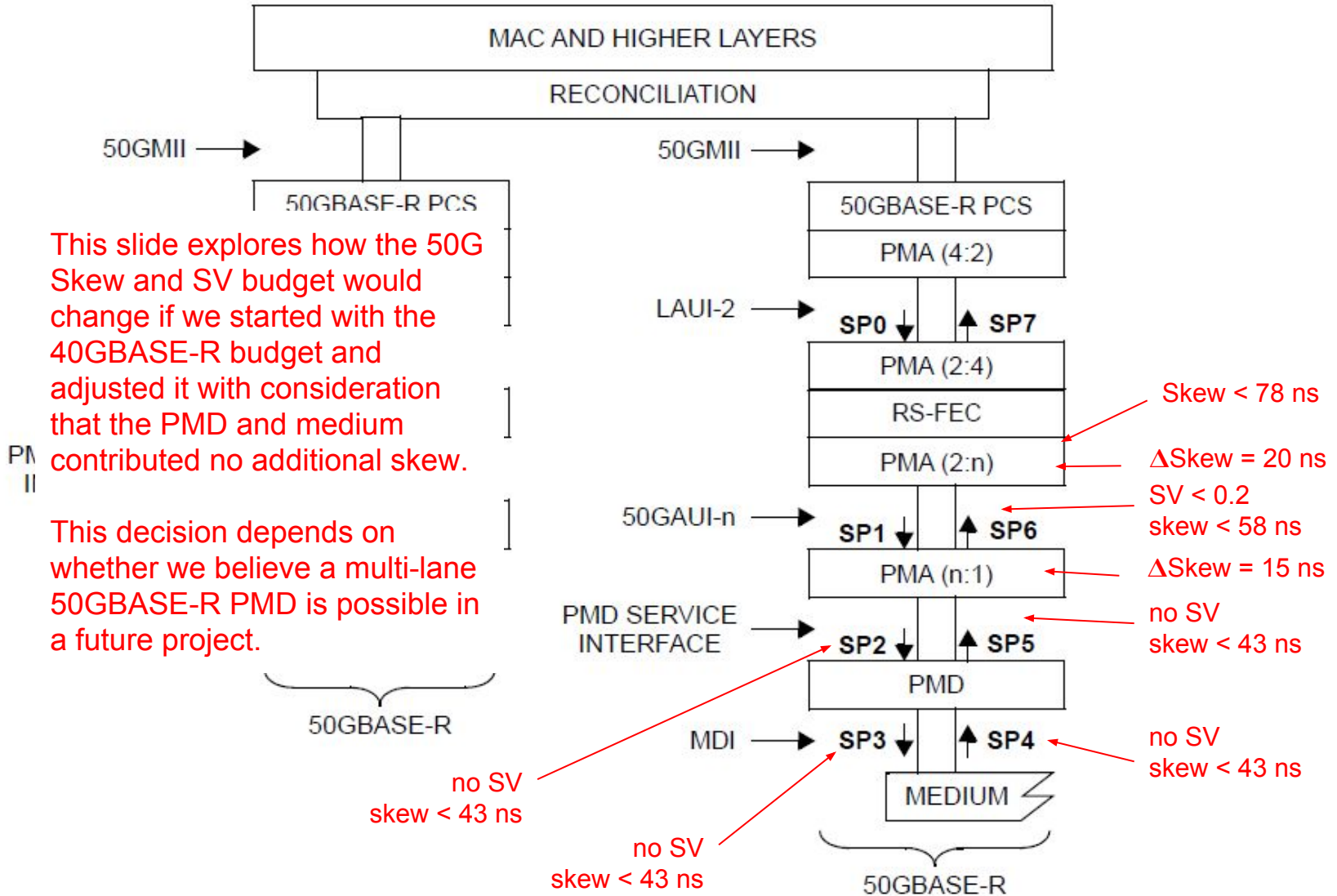# 40G/100GBASE-R Skew Variation (SV) constraints per Clause 80

Table 80–7—Summary of Skew Variation co

Skew points	Maximum Skew Variation (ns)	Maximum Skew Variation for 10.3125 GBd PMD lane (UI)[a]	Maximum Skew Variation for 25.78125 GBd PMD lane (UI)[b]
SP0	0.2	≈ 2	N/A
SP1	0.2	≈ 2	N/A
SP2	0.4	≈ 4	≈ 10
SP3	0.6	≈ 6	≈ 15
SP4	3.4	≈ 35	≈ 88
SP5	3.6	≈ 37	≈ 93
SP6	3.8	≈ 39	≈ 98
SP7	0.2	≈ 2	N/A
At PCS receive	4	≈ 41	N/A
At RS-FEC transmit	0.4	N/A	≈ 10
At RS-FEC receive[d]	4	N/A	≈ 103
At PCS receive (with RS-FEC)	0.4	N/A	≈ 10

This slide maps the Skew Variation budget numbers to the skew points for 40GBASE-R and 100GBASE-R.

100GBASE-R PCS
PMA (20:n)
SP0 ↓   ↑ SP7   ← CAUI-10 or CAUI-4
PMA (n:20)
RS-FEC — SV < 4 ns
PMA (4:4) — ΔSV = 0.2 ns
SP1 ↓   ↑ SP6   ← SV < 3.8 ns
PMA (4:4) — ΔSV = 0.2 ns
SV < 0.4 ns   SP2 ↓   ↑ SP5   SV < 3.5 ns
PMD
SP3 ↓   ↑ SP4   ← MDI
MEDIUM
100GBASE-R

5

50GBASE-CR/KR/SR/FR/LR PMD skew and skew variation considering single-lane PMD/medium

This slide explores how the 50G Skew and SV budget would change if we started with the 40GBASE-R budget and adjusted it with consideration that the PMD and medium contributed no additional skew.

This decision depends on whether we believe a multi-lane 50GBASE-R PMD is possible in a future project.

MAC AND HIGHER LAYERS

RECONCILIATION

50GMII →

50GMII →

50GBASE-R PCS

50GBASE-R PCS

PMA (4:2)

LAUI-2 → SP0 ↓ ↑ SP7

PMA (2:4)

RS-FEC   Skew < 78 ns

PMA (2:n)   ΔSkew = 20 ns

SV < 0.2
skew < 58 ns

50GAUI-n → SP1 ↓ ↑ SP6

PMA (n:1)   ΔSkew = 15 ns

PMD SERVICE
INTERFACE   SP2 ↓ ↑ SP5   no SV
skew < 43 ns

PMD

50GBASE-R

MDI → SP3 ↓ ↑ SP4   no SV
skew < 43 ns

MEDIUM

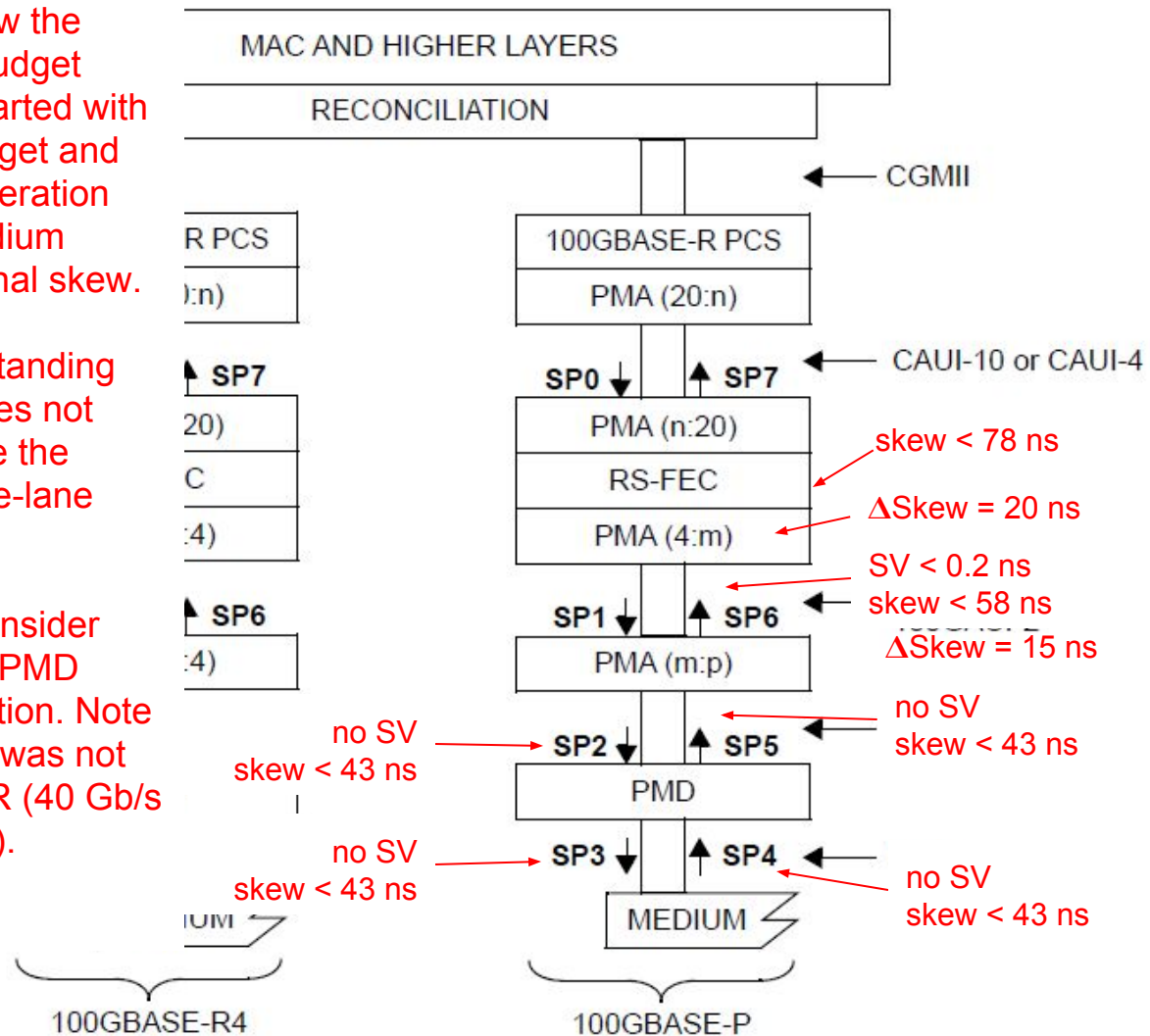no SV
skew < 43 ns

no SV
skew < 43 ns

50GBASE-R

6

100GBASE-DR Skew and Skew Variation (SV) considering single-lane PMD/medium

This slide explores how the 100G Skew and SV budget would change if we started with the 100GBASE-R budget and adjusted it with consideration that the PMD and medium contributed no additional skew.

Given that there is a standing budget for 100G, it does not make sense to change the entire budget for single-lane PMD/medium cases.

However, we might consider re-specification of the PMD Skew and Skew Variation. Note that this readjustment was not done for 40GBASE-FR (40 Gb/s 2 km single-lane SMF).

MAC AND HIGHER LAYERS

RECONCILIATION

CGMII

R PCS — 100GBASE-R PCS

):n) — PMA (20:n)

SP7 — SP0 ↓ SP7 ↑ — CAUI-10 or CAUI-4

20) — PMA (n:20)

skew < 78 ns

C — RS-FEC

:4) — PMA (4:m)

ΔSkew = 20 ns

SV < 0.2 ns
skew < 58 ns

SP6 — SP1 ↓ SP6 ↑

:4) — PMA (m:p)

ΔSkew = 15 ns

no SV
skew < 43 ns

no SV
skew < 43 ns — SP2 ↓ SP5 ↑

PMD

no SV
skew < 43 ns — SP3 ↓ SP4 ↑

no SV
skew < 43 ns

IUM — MEDIUM

100GBASE-R4

100GBASE-P

Candidate Skew budgets for 50GBASE-*R and 100GBASE-DR

Skew Points	based on 40G/100G without changes (ns)	based on 40G/100G adjusted for one-lane PMD and medium (ns)
SP0	29	29
SP1	29	29
SP2	43	43
SP3	54	43
SP4	134	43
SP5	145	43
SP6	160 (145+15)	58 (43+15)
SP7	29	29
at PCS Rx w/o RS-FEC	180	N/A
at RS-FEC Tx	49	49
at RS-FEC Rx	180 (160+20)	78 (58+20)
at PCS Rx with RS-FEC	49	49

Candidate Skew Variation budgets for 50GBASE-*R and 100GBASE-DR

Skew Points	based on 40G/100G without changes (ns)	based on 40G/100G adjusted for one-lane PMD and medium (ns)
SP0	0.2	0.2
SP1	0.2	0.2
SP2	0.4	0
SP3	0.6	0
SP4	3.4	0
SP5	3.6 (3.4+0.2)	0
SP6	3.8 (3.6+0.2)	0.2
SP7	0.2	0.2
at PCS Rx w/o RS-FEC	4	N/A
at RS-FEC Tx	0.4	0.4
at RS-FEC Rx	4	0.4 (0.2+0.2)
at PCS Rx with RS-FEC	0.4	0.4

Skew and Skew Variation Constraints Conclusions

- For all 200GBASE-R, overall and PMD Skew/SV budgets use specifications consistent with budgets in Clause 116.
- For all 100GBASE-R, overall and PMD (except 100GBASE-DR) Skew/SV budgets use specifications consistent with budgets in Clause 80.
- For 100GBASE-DR PMD, we have two choices:
  - adopt 100GBASE-R Skew/SV as specified for current multi-lane PMD
  - adopt 100GBASE-R Skew/SV with adjustments for single-lane
- For 50GBASE-R, we have two choices:
  - adopt 40GBASE-R Skew/SV budgets without modification
  - adopt 40GBASE-R Skew and SV budget modified with consideration for single-lane PMD/medium

Thanks!