Solutions for Multi-Tap DFE Error Propagation (Summary)

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#	PMD Solutions*		"PMA Remapping"	"Interleaved FEC"	
	Constrain DFE weight	EoBD (lu_3ck_01_0319)	"PMA re-mapping" / "4:1 symbol mux" (lu_3ck_adhoc_01_041019)	"2:1 bit mux" (gustlin_3ck_01_0119)	"4:1 bit mux" (nicholl_3ck_adhoc_01b_042419)
Performance	**OK**	**OK** (Best)	**OK?** (Same performance for **realistic** channels)		**OK** (Slightly worse)
Complexity Increase — Host IC	**Negligible**		**Negligible**	**1x 50G RS(544, 514) Encoder/Decoder.**	
Complexity Increase — CDR	**0**		**0** FEC decoders have already been integrated inside CDR.	Duplex FECL processing 2x 50G + 1x 100G RS(544, 514) Encoder 1x 50G RS(544, 514) Decoder. **All the functions are mandatory.**	
Latency Increase — Host IC	**0**		**0**	**>50ns**	
Latency Increase — CDR	**0**		**0ns w/o "FEC recovery" support;** ~100ns w/ "FEC recovery" support.	**>150ns 1 CDR; >250ns 2 CDR.**	
Protocol independent "FEC recovery" support	**No,** Historical burden must be carried on.		**Yes,** FEC can be self-synchronized.	**No,** Has to process duplex FECL and do "FEC conversion".	
Define new Alignment Markers	**No**		**No**	**Yes**	**No**
Standard Effort	**None**		**Minor ****	**A New Clause** for "FEC conversion".	
Recommendation	**Preferred**		**Optional**, to support easy RS(544, 514) FEC termination.	**Not**	

* More PMD solutions are available.
** Optional PMA-remapping function within PMA Sublayer.

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Summary

- No evidence shows that there is FEC performance concern of multi-tap DFE receiver that cannot be addressed by "PMA remapping" or PMD solutions (e.g. constraining DFE weights or EoBD). The EoBD provides the best performance with negligible cost in latency and complexity.

- No result shows that the "Interleaved FEC" has better performance than "PMA remapping (symbol mux)" in realistic channels.

- "Interleaved FEC" will introduce more latency and complicated CDR, which is unnecessary.

- Recommend to adopt PMD solutions and reuse the C2M clauses for 100G CR/KR.

- If we do need to consider the minor "difficult channels" (which are not found yet!), the optional "PMA remapping" function is suggested, since it has the same performance as "Interleaved FEC" and additional system benefit can be obtained i.e. Protocol independent "FEC recovery".

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Thank you !

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Reference

- FEC performance concern for 100GE-CR1/KR1 multi-tap DFEs with 4:1 bitmux PMA was shown in anslow_3ck_01_0918 with [0.7 0 0.2 0 0.2] channel. [0.7 0 0.2 0 0.2] is not a realistic channel and is too pessimistic, which is shown in lu_3ck_adhoc_01a_010219 and lyubomirsky_3ck_01a_0319.

- Interleaved FEC with 2:1 bit mux was proposed in gustlin_3ck_01_1118; Interleaved FEC with 4:1 bit mux was proposed in nicholl_3ck_adhoc_01b_042419. In-depth analysis of interleaved FEC was given in lu_3ck_adhoc_01_022719, which shown that Interleaved FEC will introduce more latency and complicated CDR, which is unnecessary and not affordable for some applications.

- PMD, PMA and FEC sublayer solutions for multi-tap DFE error propagation problem were analyzed in lu_3ck_02_0319. EoBD solution was discussed in lu_3ck_01_0319 ; PMA remapping was discussed in lu_3ck_adhoc_01_041019. "PMA remapping" has the same performance as interleaved FEC with 2:1 bitmux PMA, and it can support "Protocol independent FEC recovery".

- Contributions that shown PMA remapping (symbol mux) and interleaved FEC with 2:1 bitmux has the same performance in realistic channels: anslow_3ck_01_0119 page 12 &13, anslow_3ck_adhoc_01_041019, lyubomirsky_3ck_01a_0319. wu_3ck_01b_0319 shown that the equivalent DFE weight is smaller than 0.85, it can be verified by checking DFE weight database sun_3ck_02a_0119.

- EoBD (lu_3ck_01_0319) provides the best performance with negligible cost in latency and complexity anslow_3ck_adhoc_01_041019.

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