

# Auto-Negotiation for Dual mode FEC

Yan Zhuang, Huawei  
Yuchun Lu, Huawei



# Introduction

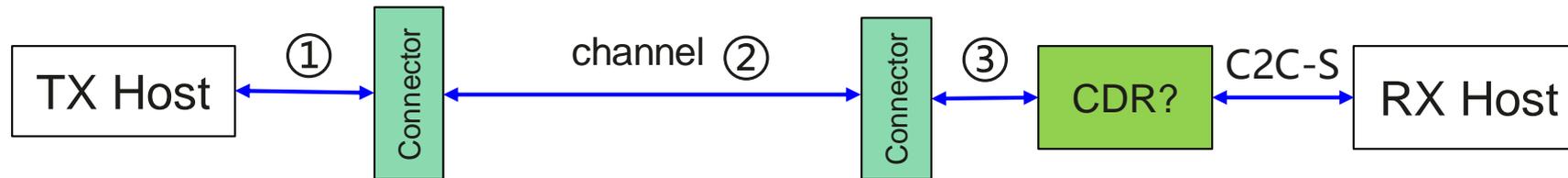
- This presentation is to explore the “AN High Level Operation” candidates for dual mode if interleaved FEC is used for 100GBASE-KR1 and 100GBASE-CR1 channels.

# Scenarios of Dual Mode FEC

- End-to-End link:
  - “Clause 91 FEC” has very clear scenarios, it must be implemented in the Host ASIC.
  - “Interleaved FEC” is dedicated for multi-tap DFE receiver under the “most difficult channel” (not found yet).
- With CDR: “Interleaved FEC” is not needed for links with retimer.
  - The links with retimers are not “difficult”, end-to end “Clause 91 FEC” is more than sufficient.
  - Neither “Interleaved FEC” on the host, nor “FEC termination/conversion” in retimer is necessary.

So, interleaved FEC is dedicated for the "most difficult channel".

# Difficult Channel is decided by the E2E link



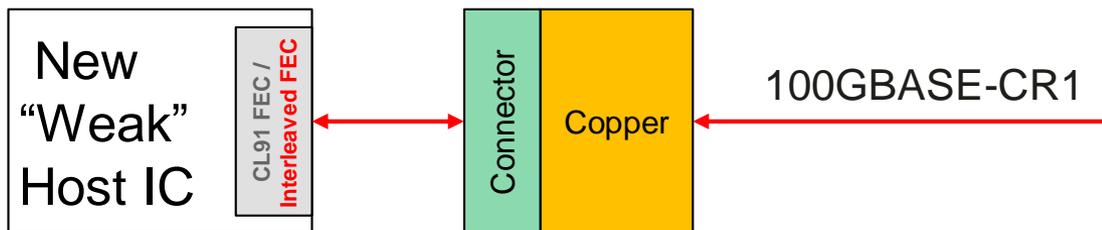
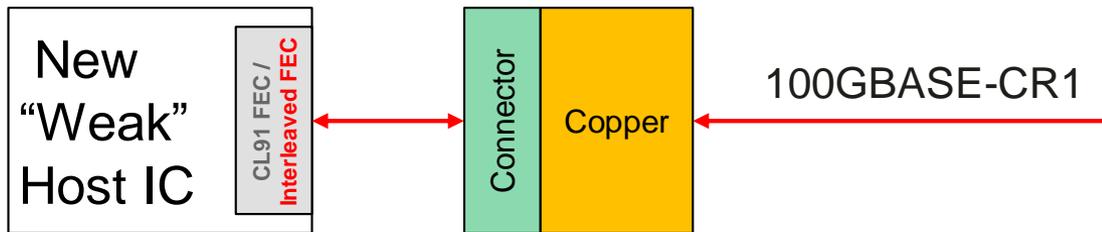
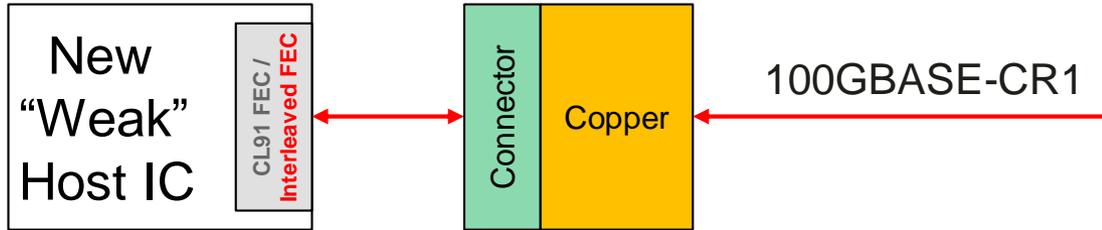
No.	TX Host①	Channel②	RX Host ③	CDR	Rx	Difficult channel?
1	--	--	--	No	1-Tap DFE	No
2	Good	--	--	No	N-tap DFE	No
3	--	Good	--	No	N-tap DFE	No
4	--	--	Good	No	N-tap DFE	No
5	Bad	Bad	Bad	No	N-tap DFE	Maybe
6	--	--	Good	Yes (RX)	--	No
7	Good	--	--	Yes (TX)	--	No

# Controversial point on Dual Mode Auto-negotiation

- **“Mandatory Interleaved FEC”**: If **either** side requests the “Interleaved FEC”, use “Interleaved FEC”; otherwise use “Clause 91 FEC”. [gustlin\\_3ck\\_01\\_0719](#)
- **“On-Demand Interleaved FEC”**: If **both** sides request the “Interleaved FEC”, use “Interleaved FEC”; otherwise use “Clause 91 FEC”. [lu\\_3ck\\_01\\_0719](#)

# We don't know who is on the other side...

## request "Interleaved FEC"



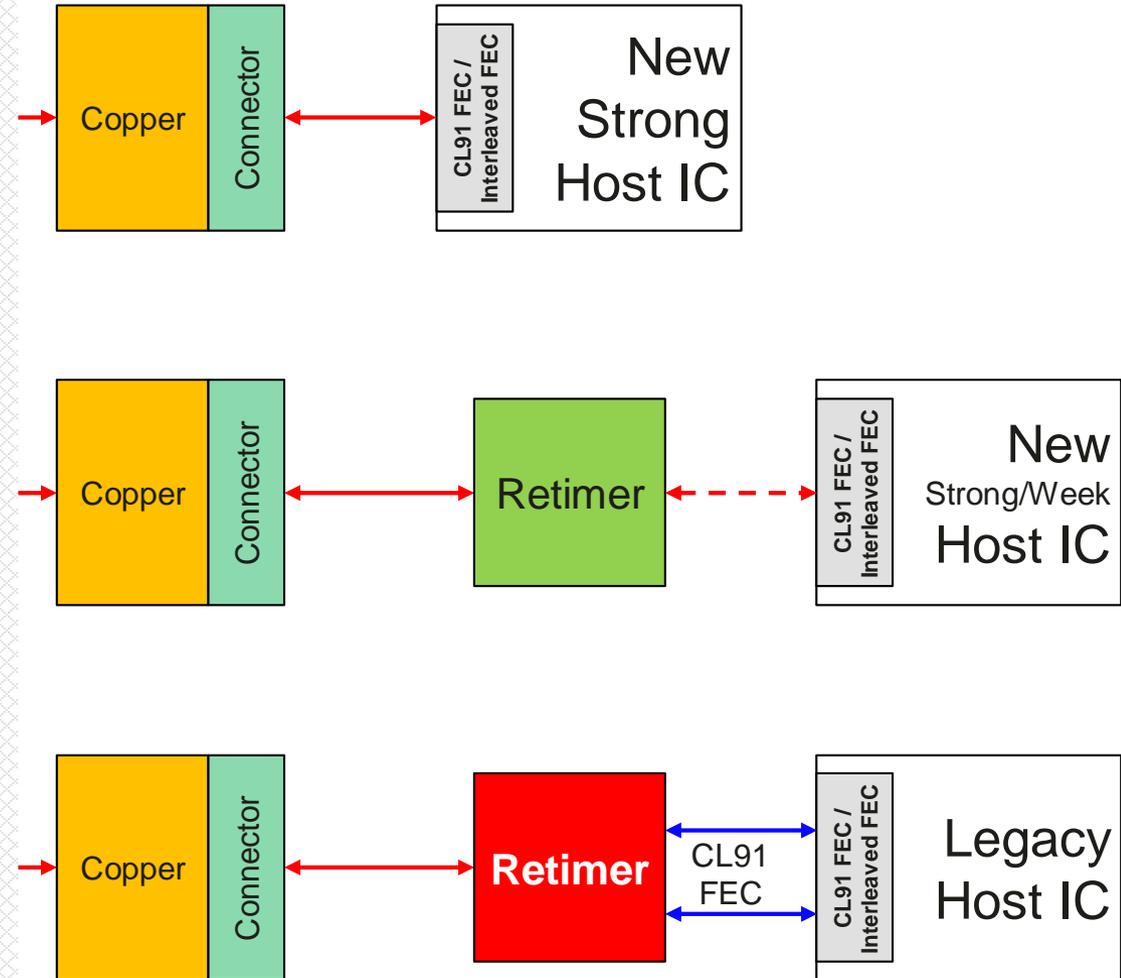
1. A "new" but "weak" host IC has FEC performance concern and **requests** "Interleaved FEC".
2. It does not know who is he talking to...

## Which FEC should be used?

- For "mandatory interleaved FEC", it should use "Interleaved FEC";
- For "on-demand interleaved FEC", it can choose.

# Let's see who might be on the other side....

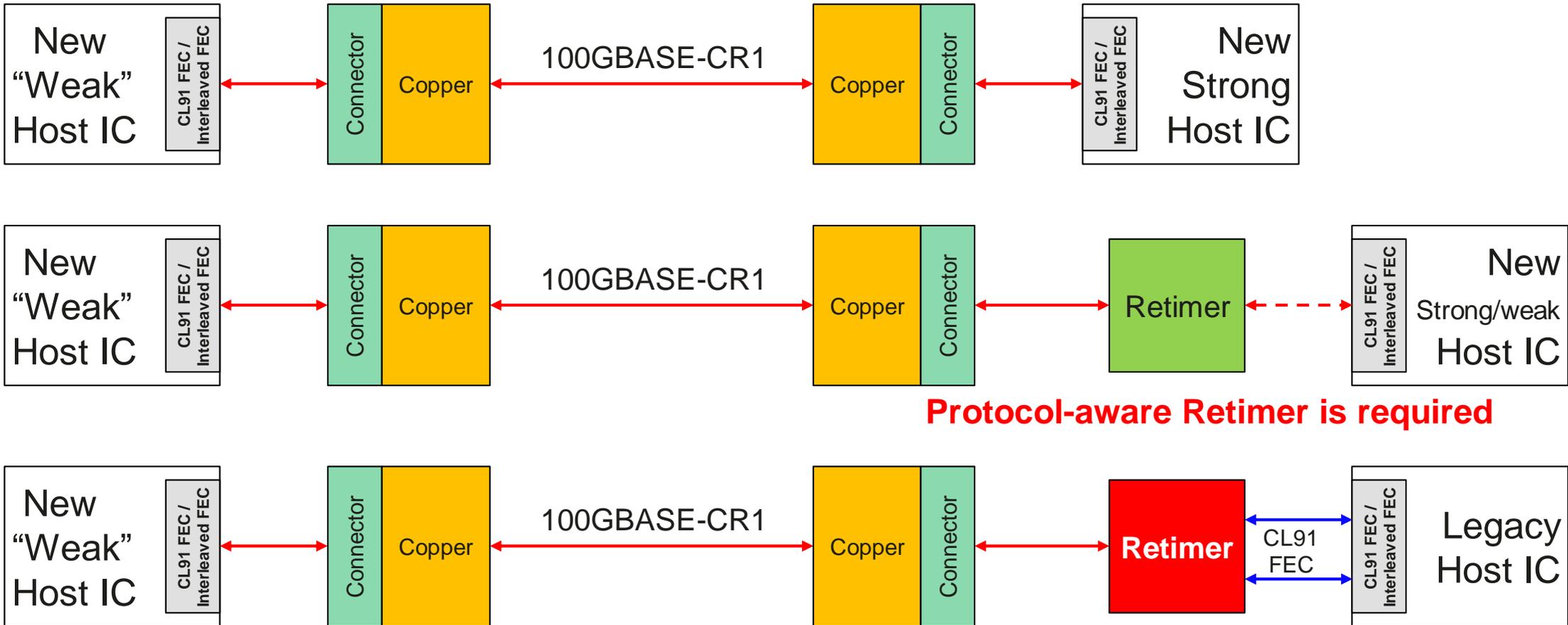
- A “new” and “strong” host IC does not have any FEC performance concern. **CL 91 FEC is enough.**
- A new strong/weak host IC but with a Retimer, then not difficult at all. **E2E CL91 FEC is sufficient.**
- The “Legacy Host IC” with a Retimer, not difficult at all. **E2E CL91 FEC is sufficient.**



**CL 91 FEC is enough for these links!**

# If “Mandatory Interleaved FEC” is applied...

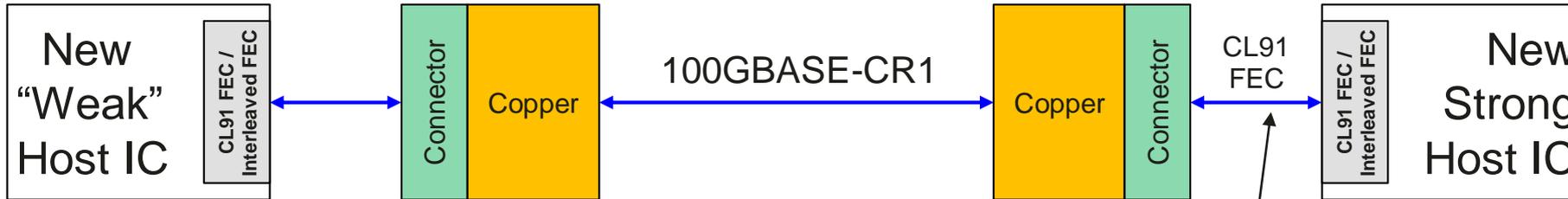
request “Interleaved FEC”



**No benefit for almost all the channels, while >50ns latency and power are paid.**

# If “On-Demand Interleaved FEC” is applied...

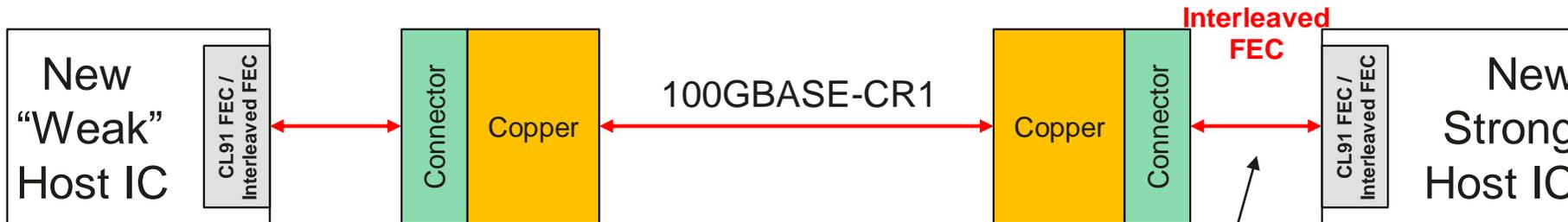
request “Interleaved FEC”



Discard “Interleaved FEC” request, because this is not a difficult channel.

High quality Host PCB / Flyover cable

request “Interleaved FEC”



May response to “Interleaved FEC”.

Marginal Host PCB

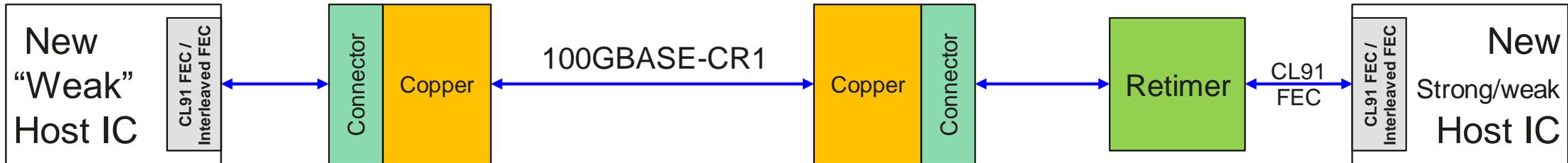
No gain, No cost. The system can choose.

“Interleaved FEC” is on when necessary, i.e. both sides request. AN works.

# If “On-Demand Interleaved FEC” is applied...with Retimer

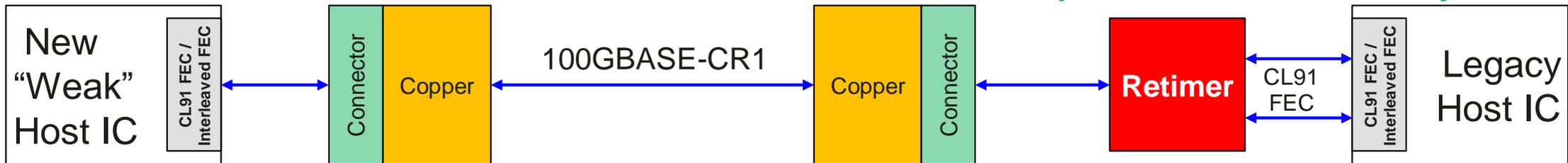
request “Interleaved FEC”

request “CL91 KP4” Protocol aware Retimer may be required but not mandatory



No gain, No cost!

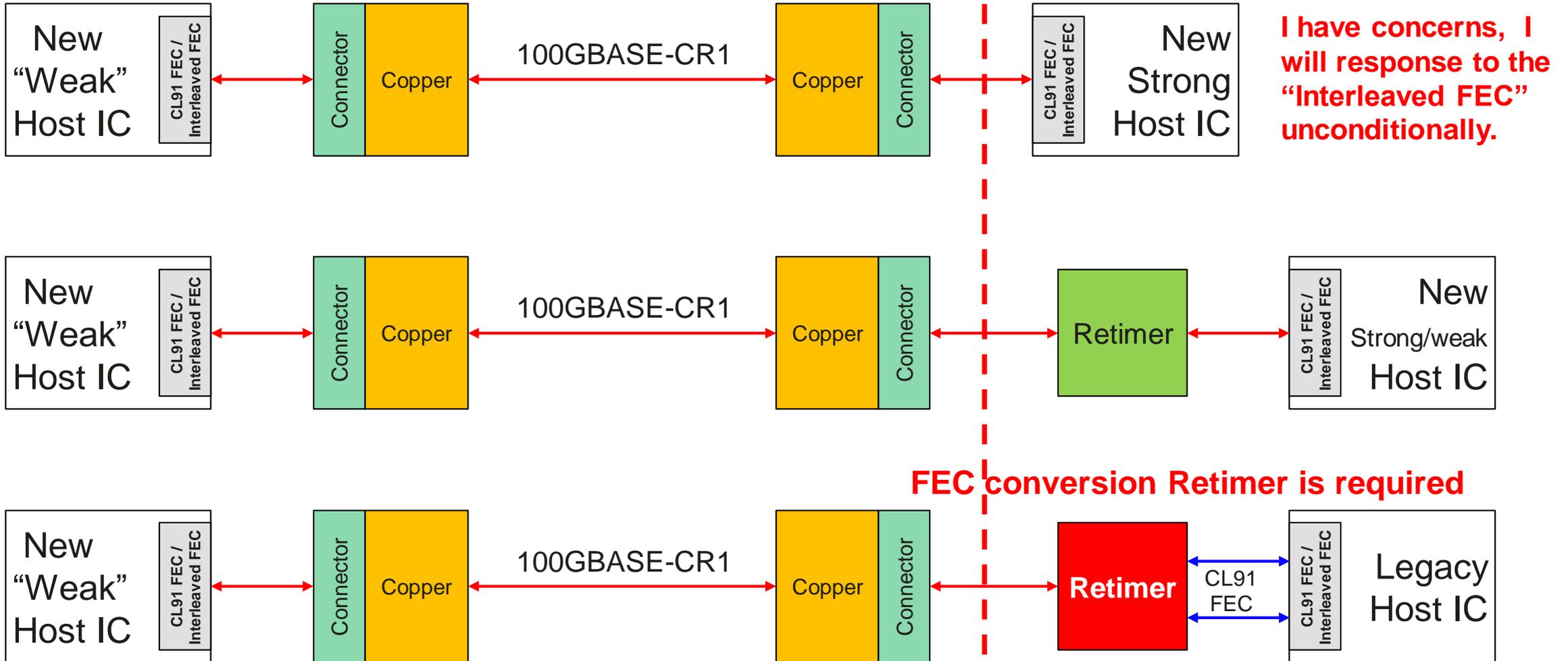
FEC conversion Retimer may be required but not mandatory



No gain, No cost!

“Interleaved FEC” is off with CDR if you don’t want.

# If “On-Demand Interleaved FEC” is applied...Always on request “Interleaved FEC”



We can have “Interleaved FEC” always on if you want.

# Summary

- For “Mandatory Interleaved FEC”, we need:
  - Protocol-aware Retimer (mandatory)
  - FEC conversion Retimer (mandatory)However, links with retimers are not difficult channels.
- For “On-Demand Interleaved FEC”, we can:
  - Use “Interleaved FEC” only when needed. No gain, No Cost.
  - Provide low latency and high reliability.

**“On-Demand Interleaved FEC” is recommended to benefit both sides!**

# Thank you !

把数字世界带入每个人、每个家庭、  
每个组织，构建万物互联的智能世界。

Bring digital to every person, home, and  
organization for a fully connected,  
intelligent world.

