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# Musings on FEC for 400 Gb/s Ethernet

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# Topics

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- Background
- 400GbE application recap
- 400GbE applications and FEC requirements
- Summary

# Background

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- At the Victoria meeting a straw poll indicated strong support for FEC being an integral part of the 400GbE architecture:

Strawpoll #4 Made by Mark Gustlin

I believe that FEC should be an integral part of the 400GbE architecture

Results

Yes	44
No	1
Undecided	27

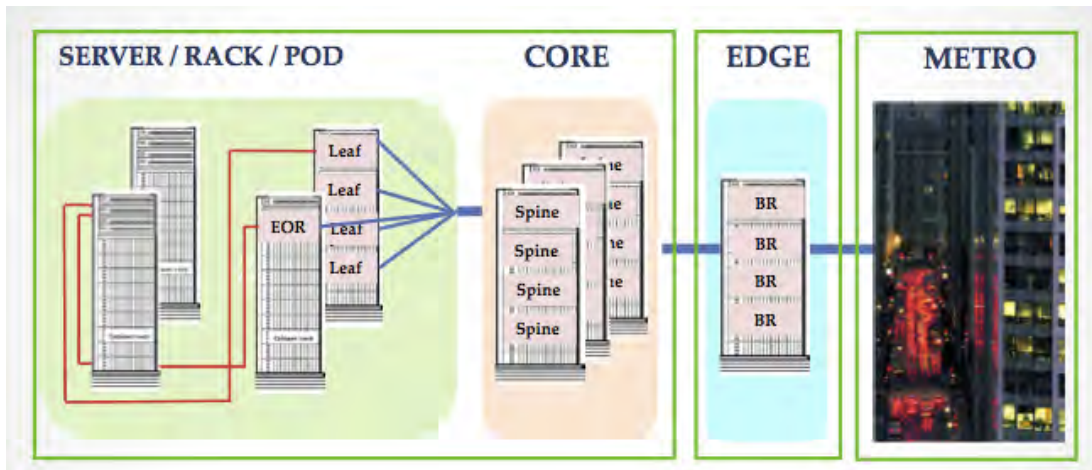
- Many people appear to be assuming a single “802.3bj ‘like’ FEC”, and with the FEC being mandatory and an integral part of (and inseparable from) the PCS.
- Does this makes sense ?

# Applications for 400GbE

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- 400GbE will address multiple different applications over it's lifecycle.
- Each application space will likely have it's own optimized PMD (or set of PMDs)
- FEC requirements are likely to vary depending on the PMD
- As indicated in nicholl\_01a\_0513, the 400GbE architecture should be defined to support all applications (i.e. long shelf life), whereas PMDs will be rolled out over time as and when they are required to meet a given application need.
- Bearing all this in mind does it make sense to define a single mandatory FEC as part of the baseline architecture ?

# Applications for 400GbE



Source: [dambrosia\\_400\\_02\\_0513.pdf](#)

- Four primary application ‘spaces’:
  1. Within the shelf, i.e. traditional backplane application.
  2. Within the rack, i.e. server interconnect
  3. Within the building, i.e. data center interconnect
  4. Outside the building, i.e. campus and metro
- What are the likely FEC requirements for these different applications ?

# “Within the shelf (Backplane)”

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Source: Google Search

- 0-1m over backplane.
- Addressing blade server to blade server interconnect across a backplane.
- Timeline is much further out, and gated by 400GbE available on servers (8-10+ years out ?).
- Too early to comment on possible implementation, but a reasonable assumption is that it will require a much higher performance FEC than the 802.3 bj FEC being used for 100GbE backplane today.

# “Within the rack (Server)”

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- 0-5m
- Primarily addressing server to top-of-rack switch interconnect.
- Again timeframe is much further out, and gated by 400GbE available on servers (8-10+ years out ?).
- Likely to be direct attach copper, or more likely some kind of active cable (copper or optical).
- It is too early to tell whether an 802.3bj performance FEC will be sufficient or not.



Source: Google Search

# “Within the building”

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Source: Google Search

- 0-500m
- Addressing interconnect among equipment within the data center and service provider central office
- Historically a mix of MMF and SMF solutions, but trending towards SMF only as data rates increase.
- Likely to be the dominant optical 400GbE PMD (think 10GBASE-SR)
- A duplex, SMF solution is preferred (all else being equal)
- Solution likely to be based on 4 x WDM 100G Adv mod
- Will likely require a different coding structure and significantly more powerful FEC than 802.3 bj (e.g. DSQ coding, MLC FEC)



# “Outside the building”

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Source: Google Search

- 500m – 40km
- Addressing campus and metro interconnect space
- Typically connecting buildings over single, dark fiber, SMF links
- Duplex, SMF a hard requirement
- Solution likely to be based on some combination of WDM / Adv Mod
- Will again require a significantly more powerful FEC than 802.3bj, and likely a more powerful than the 500m “data center interconnect’ solution,

# Summary

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- The different 400GbE applications likely have very different FEC requirements
- An “802.3bj like” FEC may not actually meet the requirements for any of the applications.
- We need to think carefully before assuming a single, mandatory FEC for 400GbE (especially something based on 802.3bj)
- At the very least the 400GbE architecture should be defined in such a way that FEC (mandatory or optional) is not an integral part of the PCS, and can be physically separated if required/desired.