Technical feasibility for 25G CR copper PMD

Vineet Salunke, Joel Goergen

AUG 19, 2014

25G CR copper cables

- Two types of applications / copper channels –
  - (1) Uplinks, between 2 switches.
    all specs same as 100G CR4, using RS-FEC.
  - (2) Downlinks, from TOR (switch) to NIC (server).
    reduced cable loss, unsymmetric channel, without FEC.
- Two types of 25G host ports –
  - (1) TOR (switch) – host channel loss similar to 100G CR4 (7 dB).
  - (2) NIC (server) – smaller host channel loss (3 dB).
- 25G RS-FEC
  - 25G “single lane” version of 100G KR4 RS-FEC (Clause 91).
  - For PCS and FEC encoding formats, see “ gustlin_081214_25GE_adhoc.pdf ”
  - No FEC for 25G CR “downlinks” (avoids latency of 250ns).
  - Use RS-FEC for 25G CR “uplinks”, 25G KR (backplane), and 25G SR (MMF).
  - 10G KR FEC does not provide enough coding gain.
    (~2 dB, less than one meter additional cable length).

FEC selection

- Auto Negotiation and Link Training for 25G CR
  - RS-FEC selection is done by Auto Neg protocol.
  - FEC is advertised (Y or N) based on type of host port and PMD.
  - also need to specify Link Training protocol for 25G CR and KR.

	PMD type	Host Port 1 (FEC = Y / N)	Host Port 2 (FEC = Y / N)	RS-FEC used ?
(1)	25G CR downlink	Switch (Y)	Server (N)	N (FEC selection by AN)
(2)	25G CR uplink	Switch (Y)	Switch (Y)	Y (FEC selection by AN)
(3)	25G KR backplane	Backplane (Y)	Backplane (Y)	Y (FEC selection by AN)
(3)	25G SR downlink	Switch	Server	Y (AN not used)
(4)	25G SR uplink	Switch	Switch	Y (AN not used)

25G CR channel model – Uplinks

- All specs same spec as 100G CR4, using RS-FEC.
  - added FEC latency of 250 ns.
  - FEC coding gain 5.xx dB.
  - allows cable lengths upto 5m or 6m, and thinner cables (1m, 3m).
- Loss Budget – 35 dB.
  - host channel = 7 dB x 2 = 14 dB 6” trace length on mid loss PCB.
  - raw cable = 18 dB.
  - QSFP connectors = 2 dB x 2 = 4 dB cable assembly = 22 dB.
  - total channel = 35 dB.
  - 3m cable @ 5.5 dB/m @ 30 AWG = 16.5 dB.
  - 5m cable @ 3.5 dB/m @ 26 AWG = 17.5 dB.
  - 6m cable @ 3.0 dB/m @ 24 AWG = 18 dB.

25G CR channel model – Downlinks

- Reduced cable loss, unsymmetric channel, without FEC.
  - avoids FEC latency of 250 ns.
  - allows cable lengths upto 5m.
- Loss Budget – 30 dB.
  - TOR host channel = 7 dB (+/- 1 dB)
  - NIC host channel = 3 dB (+/- 1 dB)
  - raw cable = 16 dB.
  - QSFP connectors = 2 dB x 2 = 4 dB cable assembly = 20 dB.
  - total channel = 30 dB.
  - 3m cable @ 5.5 dB/m @ 30 AWG = 16.5 dB
  - 5m cable @ 3.0 dB/m @ 24 AWG = 15 dB.
- MTTFPA needs to be analysed.
  - Concern of MTTFPA from DFE burst errors, for operating without FEC.
  - Option (1) – use COM method to verify if BER and MTTFPA is acceptable.
  - Option (2) – use 10G KR FEC to correct DFE burst errors.

Other related topics

- 25G C2M electrical interface (CAUI-1)
  - 25G chip to module (C2M) needed for SR (MMF) PMD and AOC cables.
  - “single lane” version of 100G CAUI-4 electrical spec.
  - chip to chip (C2C) not needed. (eg: use CEI-25G-MR).
- Host electrical connectors
  - need to consider both connectors in CR4 channel model.
  - SFP28, and QSFP28 (for breakout).

Other related topics

- HEC (host electrical compliance) tests needed –
  - TX tests –

    (1) Switch port, CR.

    (2) Switch port, C2M.

    (3) NIC port, CR.

    (4) NIC port, C2M.
  - RX (SRS) tests –

    (1) Switch port, CR, no FEC @ BER ~ e-12.

    (2) Switch port, CR, with FEC @ BER ~ e-5.

    (3) Switch port, C2M, no FEC @ BER ~ e-12.

    (4) NIC port, CR, no FEC @ BER ~ e-12.

    (5) NIC port, C2M, no FEC @ BER ~ e-12.

Thank You !