Two cable types for 25GBASE-CR and 25GBASE-CR-S

Addressing Draft 1.0 comments:
86, 87, and many others

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P802.3by Chief Editor

Introduction

- Draft 1.0 comments 86 and 87 propose that …
  - 3 m cable may be supported with a 25GBASE-CR or 25GBASE-CR-S PHY with no FEC enabled
  - 4 m cable may be supported with a 25GBASE-CR or 25GBASE-CR-S PHY with BASE-R FEC enabled
- This presentation proposes that…
  - IF the task force approves a 3 m cable specification for no FEC operation
  - THEN only a 3 m (no FEC) cable and a 5 m (RS-FEC) cable should be specified.
- Details to follow.

Comment #86

CI **110**   SC **110.10.2**   P **150**   L **24**   # 86

Mellitz, Richard   Intel Corporation

Comment Type   **TR**   Comment Status   **X**

A base-R FEC cable assembly can support a cable up to at least 4 meters and a no-FEC
cable assembly up to a least 3 meters
See mellitz_3by_01_0515.pdf

SuggestedRemedy

Change
The measured insertion loss at 12.8906 GHz of the CA-S cable assembly shall be less
than or
equal to 16.48 dB. The measured insertion loss at 12.8906 GHz of the CA-N cable
assembly shall be less than or equal to 12.98 dB
To
The measured insertion loss at 12.8906 GHz of the CA-S cable assembly shall be less
than or
equal to 19.48 dB. The measured insertion loss at 12.8906 GHz of the CA-N cable
assembly shall be less than or equal to 15.98 dB

Proposed Response   Response Status   O

Comment #87

CI **110A**   SC **110A.5**   P **220**   L **37**   # 87

Mellitz, Richard   Intel Corporation

Comment Type   **TR**   *Comment Status*   **X**

A base-R FEC cable assembly can support a cable up to at least 4 meters and a no-FEC
cable assembly up to a least 3 meters
See mellitz_3by_01_0515.pdf

SuggestedRemedy

In Table 110A-1
Change
IL_Chmax for CA-S
From 29 to 31
IL_Camax for CA-S
From 16.48 to 19.48

IL_Chmax for CA-N
From 25.5 to 28
IL_Camax for CA-N
From 12.48 to 15.48

And on page 227 line 40ff table 110C-a
Change CA-S references for RS-FEC, BASE-R FEC from 3m to 4m and
Change CA-N references for RS-FEC, BASE-R FEC, no FEC from 2m to 4m

Proposed Response   *Response Status*   O

Draft 1.0 cable types

- Draft 1.0 defines 3 cable types
  - CA-N
    - up to 2 m
    - compatible with PHY using no FEC, BASE-R FEC, or RS-FEC
  - CA-S
    - up to 3 m
    - compatible with PHY using BASE-R FEC or RS-FEC
  - CA-L
    - up to 5 m
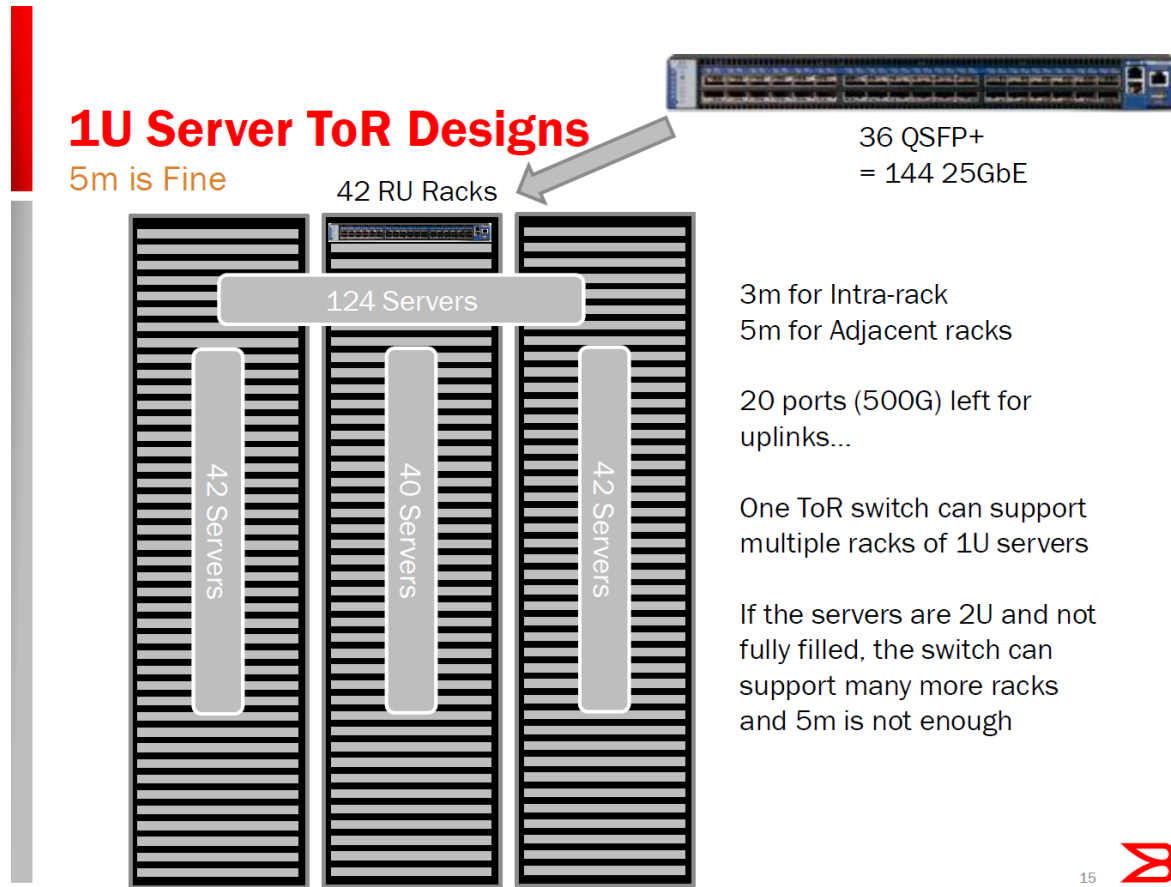   - compatible with PHY using RS-FEC

P802.3by objectives

- Define a single-lane 25 Gb/s PHY for operation over links consistent with copper twin axial cables, with lengths up to at least 3m.

- Define a single-lane 25 Gb/s PHY for operation over links consistent with copper twin axial cables, with lengths up to at least 5m.

Use cases

- Need 5 m for connection from top of rack switch to server on adjacent rack (inter-rack).

- Need 3 m for connection from top of rack switch to server on same rack (intra-rack).

- Need 2 m for connection from middle of rack switch to server on same rack (intra-rack).

- Desire for minimum latency by using no FEC, if possible.

Use case example #1

1U Server ToR Designs
5m is Fine

36 QSFP+
= 144 25GbE

42 RU Racks

124 Servers

42 Servers

40 Servers

42 Servers

3m for Intra-rack
5m for Adjacent racks

20 ports (500G) left for
uplinks...

One ToR switch can support
multiple racks of 1U servers

If the servers are 2U and not
fully filled, the switch can
support many more racks
and 5m is not enough

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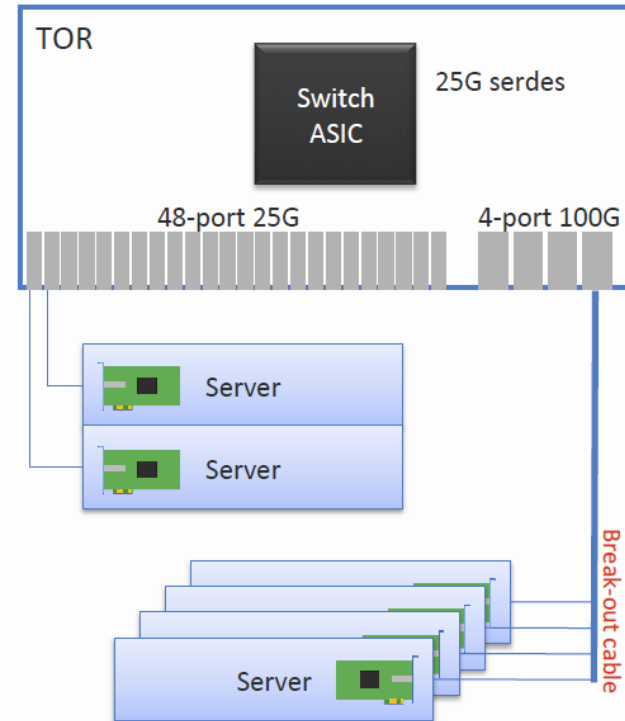http://www.ieee802.org/3/25GSG/public/Sept14/kipp_25GE_01_0914a.pdf
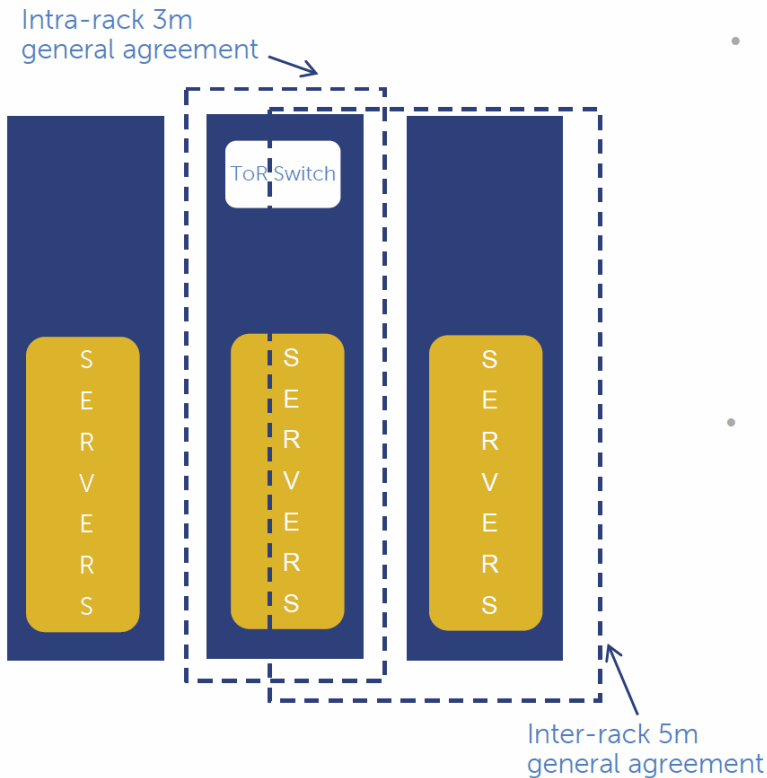
Use case example #2

25Gb/s Ethernet Connectivity

- Enables similar topology as 40Gb/s & 10Gb/s
  - Single 25Gb/s SFP28 port implementation or Quad 25Gb/s QSFP28 breakout implementation possible
  - Maximizes ports and bandwidth in ToR switch faceplate
  - Dense rack server
  - Within rack, less than 3m typical length

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IEEE 802.3 Call For Interest – 25Gb/s Ethernet over a single lane for server interconnect – July 2014 San Diego

http://www.ieee802.org/3/cfi/0714_1/CFI_01_0714.pdf

Use case example #3

Cu Cable Distribution

Intra-rack 3m general agreement

ToR Switch

SERVERS | SERVERS | SERVERS

Inter-rack 5m general agreement

- Data obtained from
  - Two product groups within Dell (past 1 to 1.5 years)
  - 10GbE based products (servers & switches)
  - 40GbE based products (servers & switches)

Total (Cu Cable)	Division A	Division B
<=3m	79%	63%
5m	21%	28%
>5m	0%	8%

- Data obtained from
  - Two cabling companies (Molex, TE Connectivity)

Total (Cu Cable)	Company A MDI1/MDI2	Company B
<=3m	62% / 69%	80%
5m	30% / 24%	15%
>5m (Passive)	1%	5%
>7m (Active)	7% / 6%	-

IEEE 802.3 25GbE Study Group
Sept 2014 Interim, Kanata, Canada

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http://www.ieee802.org/3/25GSG/public/Sept14/dambrosia_25GE_01_0914c.pdf

Use case example #4

Data Center Cable Length Scenarios

Examples from Microsoft Data Center usage.

Compute rack with "TOR" switch in middle of rack
- E.g. rack with 4 Open Compute Server (OCS) chassis (96 blades) per rack with single switch
- Cable lengths: 0.5m, 0.75m, 1.0m, 1.5m, 2.0m
- All server-TOR links are candidates for "no FEC"

3m and 5m requirements exist but much lower volume
- Cross-rack connections
- Chassis extension requirements, e.g. hot swap disk drawer
  - Majority of cables in rack are still <= 2m

Bump-in-the-Wire topologies
- Single board implementations may use "KR" spec
- Multi-board implementations may use 0.5m cable

IEEE 802.3BY TASK FORCE   3

http://www.ieee802.org/3/by/public/Jan15/andrewartha_3by_01a_0115.pdf

Observations

- Two cable types addressing, 3 m and 5 m reach, meets the project objectives.

- A 3 m cable specification requiring no FEC
  - addresses the desire for a low latency intra-rack connection
  - addresses the shorter 2 m reach for middle of rack switches.

- The BASE-R FEC is no longer required to meet the system requirements for 3 m but may still be useful for improving link performance or robustness when desired or necessary.

- <u>A third cable type addressing 4 m reach and requiring a BASE-R FEC does not address a distinguishable system use case.</u>

Proposal

- Retain CA-L cable type for 5 m reach.
- Change CA-S cable type for 3 m reach as follows:
  - FEC no longer required
  - new cable specifications
- Drop CA-N cable type.
- Retain BASE-R FEC for use with CA-S cables at user discretion to:
  - improve MTTFPA
  - improve BER (e.g., 1E-15)
  - extend reach beyond 3 m

Thank you!