



Applications and PMD Objectives for this 400GbE project

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Topics

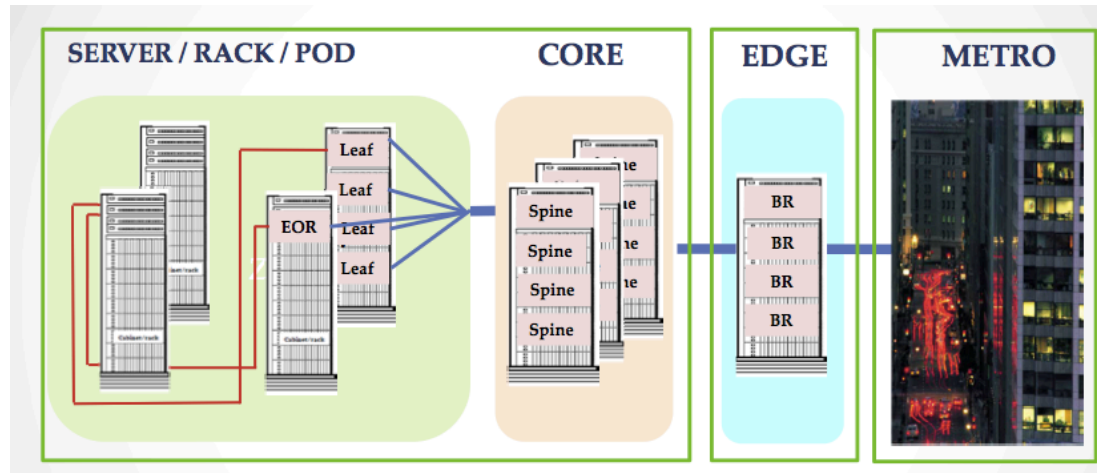
- Introduction
- Applications Overview
- Applications for this 400GbE project
- Lessons from 100G Deployment
- Summary

Introduction

- Application space evolves over the life-cycle of a given Ethernet data rate
- Applications typically start at the core of the network (lower volume, strategic importance) and migrate to end user / compute (high volume, commodity) over time
- Different applications have different PMD requirements
- This 400GbE project should focus on defining PMDs needed for the initial 400GbE application space
 - There will be future 400GbE projects (we don't need to to define every possible PMD now!)

Let's be honest about the initial application space

Application Spaces



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Four distinct application spaces:

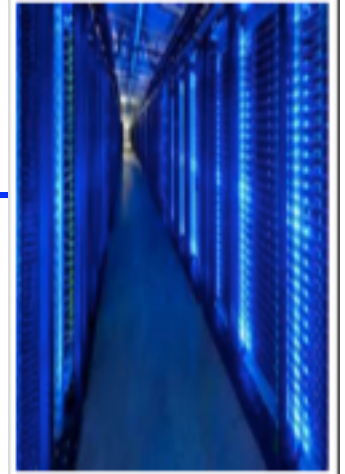
1. Within a Shelf: Blade server interconnect across backplane
2. Within a Rack: Server to TOR switch interconnect
3. Within a building: Data Center / Central Office interconnect
4. Outside a building: Interconnect across campus and metro

“1) Within a Shelf (Backplane)”

- 0-1m over a backplane.
- Addressing blade server to blade server interconnect across a backplane.
- Timeline is much further out. Triggered by availability of 400GbE interfaces on servers (8+ years out ?).
- Not the target for this 400GbE project



“2) Within a Rack (Server)”



- 0-3m
- Addressing server to Top-of-Rack switch (TOR) interconnect.
- Timeframe is much further out. Again triggered by availability of 400GbE interfaces on servers (8+ years out ?).
- Potentially addressed by active cables (optical or copper)
- Not the target for this 400GbE project

“3) Within a Building”



3a)

- Within the row (i.e. TOR to EOR/MOR switches)
- 0-30m
- Potentially addressed by active cables (optical or copper)
- **Not the target for this 400GbE project**

3b)

- Interconnect among equipment (switching, routers, transport, etc) within data center and/or central office
- 0 – 500m
- 3-6dB loss budget (splitters, patch panels, etc)
- SMF duplex preferred
- **Probably the main application for this 400GbE project**

“4) Outside a Building”



4a)

- Campus interconnect
- 0-2 to 3km
- SMF duplex solution mandatory
- Potential application for this 400GbE project ?

4b)

- Metro interconnect (across city/metro area)
- 0-40+km
- Single fiber, SMF duplex solution mandatory
- Not the target for this 400 GbE project ?

Application Takeaways

- 3b (within building) is the primary application for this 400GbE project
 - 500m, 3-6dB loss budget, SMF duplex preferred
- 4a (campus) may be a secondary application for this project
 - 2-3km, SMF duplex mandatory
- 1, 2 and 3a are not the targets for this 400GbE project
 - Gated by 400GbE servers (much further out in time)
 - Active cables may address some of these applications without requiring future PMD standardization
 - No objectives in this project for these applications
- 4b (metro) needs further discussion
 - What is the correct reach and the correct timing ?

Lessons from 100G

802.3ba defined four different 100G PMDs:

- 100GBASE-CR10 7m on copper
- 100GBASE-SR10 100m on MMF Ribbon
- 100GBASE-LR4 10km on SMF duplex
- 100GBASE-ER4 40km on SMF duplex

What has been deployed over the past 3 years (Cisco data) ?

- 100GBASE-CR10 0%
- 100GBASE-SR10 11%
- 100GBASE-LR4 89%
- 100GBASE-ER4 0%

Note: Similar data from multiple vendors presented in moorwood_400_01_1113

Takeaways from 100G deployment ?

100G-LR4:

- The dominant 100G PMD type to date.
- Primary application is core IP networking, i.e. core router to core router and core router to DWDM transport, all within a building (< 500m).
- Consistent with historical introduction of a new data rate.
- Surprisingly, 100G-SR10 has gained little traction in this application space, despite a significantly lower cost point.
 - Why ??

Takeaways from 100G deployment ?

100G-SR10:

- The 802.3ba PMD targeted for DCs.
- Very cost competitive with current 10G MMF solutions, being deployed in high volume in DCs today.
- Despite this there has been virtually zero volume deployment in mainstream data centers to date.
- Why ??
 - It is certainly not because of cost.
 - Is it because of reach ?
 - Is it because of the ribbon fiber ?
 - Is it because there is no demand for 100G in DCs ?
 - Is it because of something else ?

Summary

- Early market applications for 400 Gb/s Ethernet will be similar to those seen in early market 100 Gb/s Ethernet.
- PMD types seen in these early market 400 Gb/s applications are expected to be similar to those seen in early market 100 Gb/s applications.
- Let's learn from history, be honest with ourselves and target the PMD objective(s) for this project accordingly.