

Extended Reach for 50/200/400GbE

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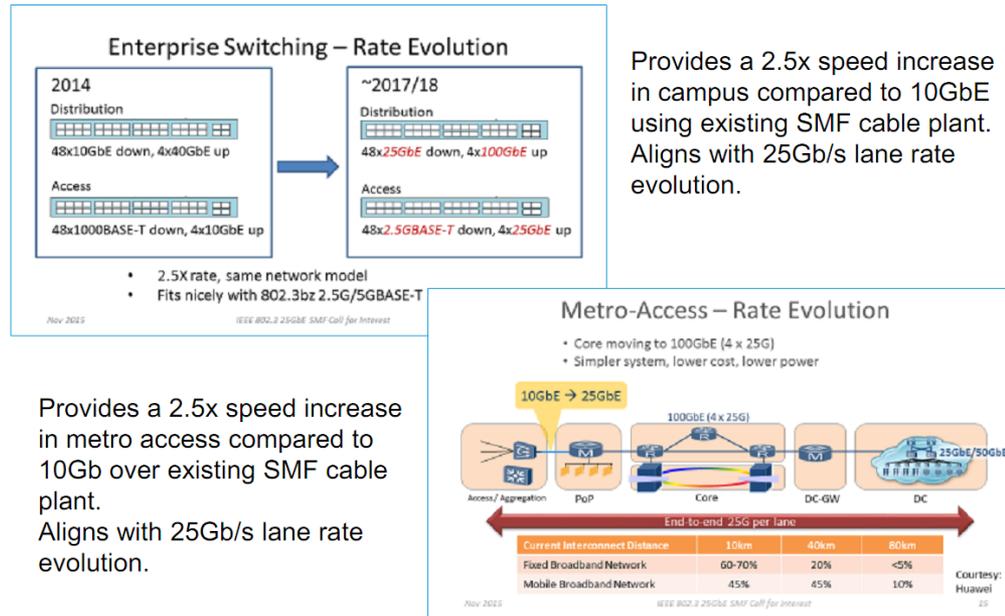
Gap of IEEE 50/200/400GbE Standard

- 40km extend reach of 10/100GbE SMF PMDs in IEEE 802.3 have been released in last several years
- 40km extend reach of 25GbE SMF PMDs is under developing in 802.3cc project
- For 50/200/400GbE SMF PMDs, no more than 10km reach objective in 802.3cd/bs project
- 40km in 50/200/400GbE standards will help to build a total solution by Ethernet eco-system

User case of 50GbE-40km

- As in “[jones_25gsmf_01a_0116](#)”, 10/40km objective is included in 802.3cc for 25GE SMF with the following user cases:

Use cases discussed in CFI



- 50GbE can further provide 2X speed increase for campus and metro interconnect application

200GbE Application Scenarios

- In “[cole_50GE_NGOATH_01_0316](#)” of 802.3cd:

End User Comments

- Hong Liu, Google

“Google is interested in 200Gb/s MAC. 200Gb/s Ethernet has larger radix than 400Gb/s Ethernet, and better hashing efficiency than 2x100Gb/s Ethernet.”

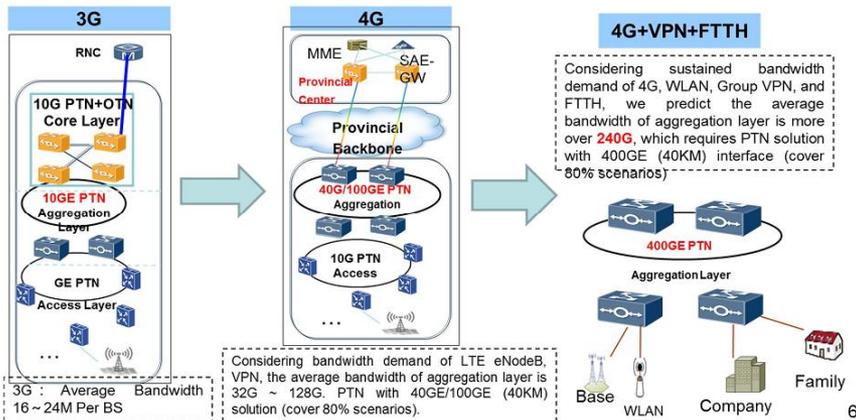
- Yuval Bachar, LinkedIn

"200G is a step in the network evolution that we cannot skip based on the pace of the data needs growth and the mismatch between that growth and the optical module development cycle. For LinkedIn we see a path where 200G will be our fabric connectivity speed that will enable us to address our future network needs"

Extend Reach PMDs Application in 400GbE

□ Link Scenario in Backhaul Network

- Based on Ethernet technology, we choose PTN to build the mobile backhaul networks of China Mobile
- Because backhaul network is in metro area, where is usually lack of OTN, most of link between PTN nodes are direct fiber connection
- With the large scale deployment of TD-LTE, PTN is evolving from 10GE to 40GE/100GE, and we believe 400GE will be necessary in the near future



[huang_3bs_01_0714](#)

□ 400GbE extended reach PMD

Extended reach(>10km) interface is essential for inter-building connections without long-haul transmission systems.

Media	Duplex single mode fiber		
	2km	10km	40km
Application	Intra-building Inter-building usage #1 Inter-building usage #2		
802.3bs Objectives	✓	✓	-

Route-to-transport application

10km reach:
Covers 50% of inter-building links
40km reach(For example):
Covers almost 100% of inter-building links

Intra-building usage
2km and 10km
L2SW/Router to long-haul transport system

Inter-building usage#1
2km and 10km
L2SW/Router to long-haul transport system

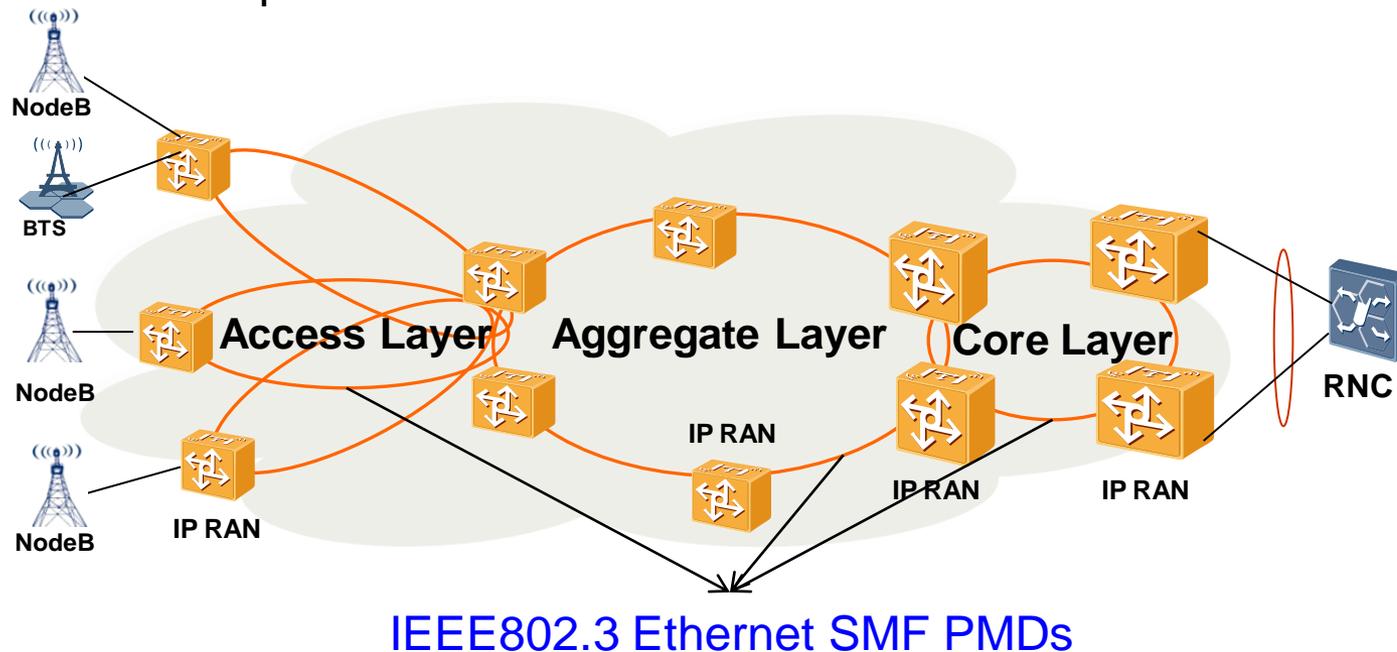
Inter-building usage #2
10km and >10km
Direct connection without long-haul transmission system

NTT

[sone_ecdc_01c_0116](#)

40km Reach in Mobile Backhaul Network

- As discussion during 802.3cd Macau meeting, it is clarified 50/200/400GbE interface can be deployed in different Ring layer respect to different geography and real time flow requirement



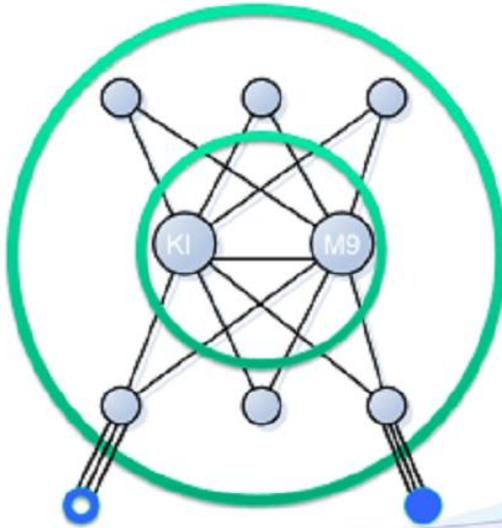
- Introducing 40km standard can help to form a whole ring topology as different reach requirement between IP RANs, only 10km standard is not sufficient.

40km Reach in DC Interconnection

Industry Discussions- MSK-IX

Double Core Specifics

- MLAG interaction between KI & M9 (~40km distance)
- Passive 10G DWDM solution between core, predictable network size
- Smooth migration from old equipment to a new one
- Ring-topology concept:
 - Tier 0 – connect core to each other,
 - Tier 1 – core datacenters and switches,
 - Tier 2 – edge datacenters.
- Current capacity between several Tier1 switches and Core: 640Gbps (n x 10G) with Future plans 100G+ links between them.
- **Need solution for 100G+ optical transceivers between Core & Tier1 up to 40 km**



MSK IX

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Courtesy: Alexander Ilin, MSK-IX

IEEE 802.3 NG ECDC Ad Hoc, IEEE 802.3 May 2016 Interim, Whistler, BC, Canada

Refer: [dambrosia ecdc 01 0516](#)

Summary

- More than ~1 million units of 1G/10GbE-40km modules have been shipped
- For 40/100GbE-40km, we observe increasing shipment with more than 10k units from 2016
- For 40km extend reach in 50/200/400GbE standard, we expect they will contribute to diversity user application and promote Ethernet eco-system

Thank You