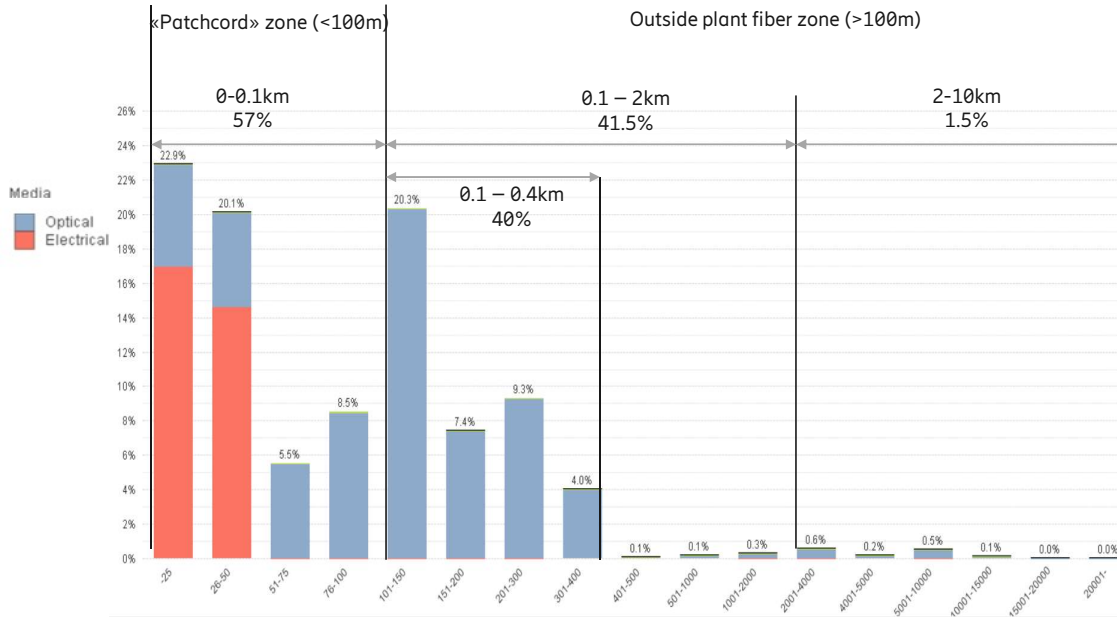




The case for 2km BiDi in RAN

Fronthaul link length distribution (D-RAN)

D-RAN only, ~ few millions of installed links



Historical «≤4G» data, courtesy of Ericsson

Distributed

Centralized

Analysis of the three connectivity domains

/1



0-100m

D-RAN sites, with DU's in close vicinity of the RU's

- DU and RU on the same rooftop
- DU at the bottom of the cell tower
- «Fiber resources» are optical patch-cords

IEEE802.3 traditionally covers this space with *duplex fiber short reach multimode interfaces*

- 10GBASE-SR, 25GBASE-SR, 50GBASE-SR, ... : VCSEL-based, perfect for indoor
- Adapting them for outdoor use is not impossible, but adds challenges/cost

Mobile industry de-facto standard: duplex fiber, *duplex fiber short reach single mode interfaces*

- Based on cheap laser sources (typically, Fabry-Perot DML)
- On par cost-wise with the best multimode solutions for outdoor and supporting up to 2km-ish distances
- With cost of transceivers constantly reducing, the cost of patchcords is becoming more and more relevant in % terms

Analysis of the three connectivity domains

/2



2km-10km

C-RAN deployments in relatively abundant fiber areas

- «Fiber resources» are dark fibers in an outside plant.
- xWDM systems are overkill, BiDi transceivers sufficient for wise use of fiber.

IEEE802.3 is going to effectively cover this space with the «BLR» **10km BiDi** interfaces being developed by this Task Force

Analysis of the three connectivity domains

/3



100m-2km

D-RAN sites, with DU's in relative vicinity of the RU's

- Radios on the rooftop of a building
- DU in the cellar of a building a few blocks away

«Small-scale» C-RANs

- macro densification with small cells in cities
- «baseband hotels» of limited size, and limited distances

Important: in spite of the shorter reach, «fiber resources» may still be dark fibers in an outside plant (except for the particular cases of cabling of tall buildings, etc.)

How IEEE802.3 covers this space

- For lower speeds: «LR» 10km duplex fiber (10GBASE-LR,25GBASE-LR, ...)
- 802.3cp in the process of adding «BLR» 10km BiDi single fiber
- For high bit rates, «DR»/«FR» 500m/2km duplex fiber interfaces (200GBASE-FR4, 400GBASE-DR4/...FR4?)

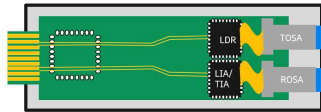
This space could be covered more effectively by cost-optimized, 2km BiDi («BFR» ?) interfaces

Every penny counts for mobile applications



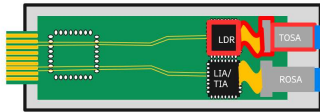
Duplex fiber 10GBASE - LR «lite»

De-facto standard in use for years now by the wireless industry



10GBASE-LR (10km)
Tx: 10G DFB uncooled, 10G LDR
Rx: 10G PIN-TIA-LIA

IEEE standard

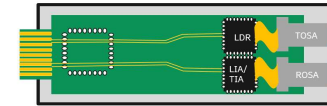


10GBASE-LR «lite» @ 10G (<2km)
Tx: 10G FP uncooled, 10G LDR
Rx: 10G PIN-TIA-LIA

Lower cost than a 10G DFB based implementation
Use a 10G FP, trade fiber loss for TDP

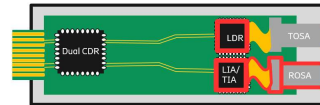
Duplex fiber 25GBASE - LR «lite»

De-facto standard for duplex fiber being adopted by the wireless industry



10GBASE-LR (10km)
Tx: 10G DFB uncooled, 10G LDR
Rx: 10G PIN-TIA-LIA

IEEE standard



25GBASE-LR «lite» @ 25G (2km)
Tx: *the same* 10G DFB uncooled, 25G LDR
Rx: 25G PIN-TIA-LIA

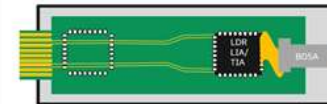
Lower cost than a 25G DFB based implementation
Use a 10G DFB, trade fiber loss for TDP

Three transceiver Vendors developing it
I-temp = for mobile market
Expected savings up to 25%
with respect to a 25G DFB-based implementation

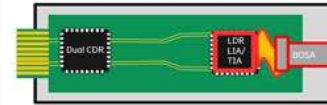
Principle: trade «fiber loss» for TDP allowing use of cheaper lasers (while still supporting 6 connectors)

2km 25G, reuse of 10km 10G bidi technology

«low hanging fruit..»



10km BiDi @ 10G, 1270nm/1330nm
Tx: 10G DFB uncooled, 10G LDR
Rx: 10G PIN-TIA-LIA



2km BiDi @ 25G
Tx: *the same* 10G DFB uncooled pair, 25G LDR
Rx: 25G PIN-TIA-LIA

Take-aways



There may be space, for mobile applications, for cost-optimized 2km BiDi («BFR»?)

- Halving the number of fibers is always very important when dark fiber in outside plant must be used, regardless of the distance
- Every penny counts in mobile applications

The transceiver industry is already working on a «low hanging fruit», 25G 2km BiDi obtained by reusing technology from existing 10G 10km BiDi

- Opportunity for early interception of another «de-facto» mobile standard, turning it into an IEEE standard

In the traditional very short reach (0-100m) «patch-cord» domain the cost of patchcords begins to matter

- If «duplex single mode transceivers + 2 single mode patch-cords» can be shown to break-even with «BiDi + 1 single mode patch-cord», perhaps a relevant portion of the mobile optical interconnects space (now covered by «de facto» standards) could be «won back to IEEE802.3 »