



Leading Telecommunication Networks

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Short Haul WDM solutions.



Marcin Bała

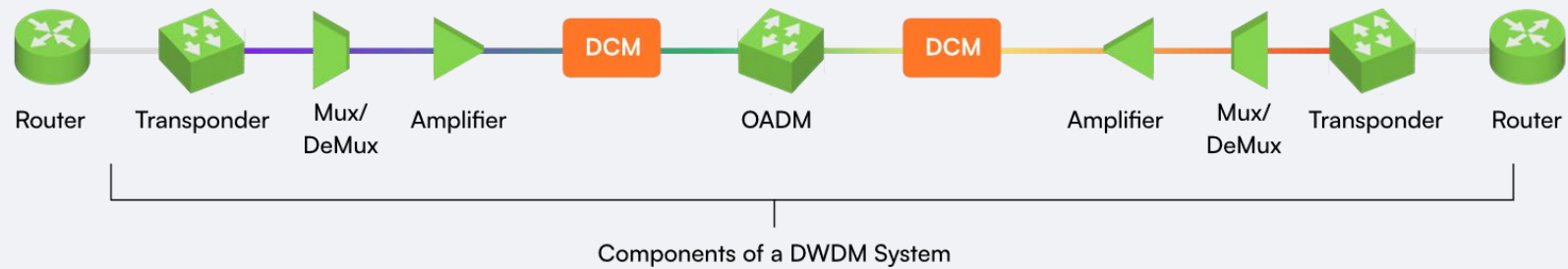
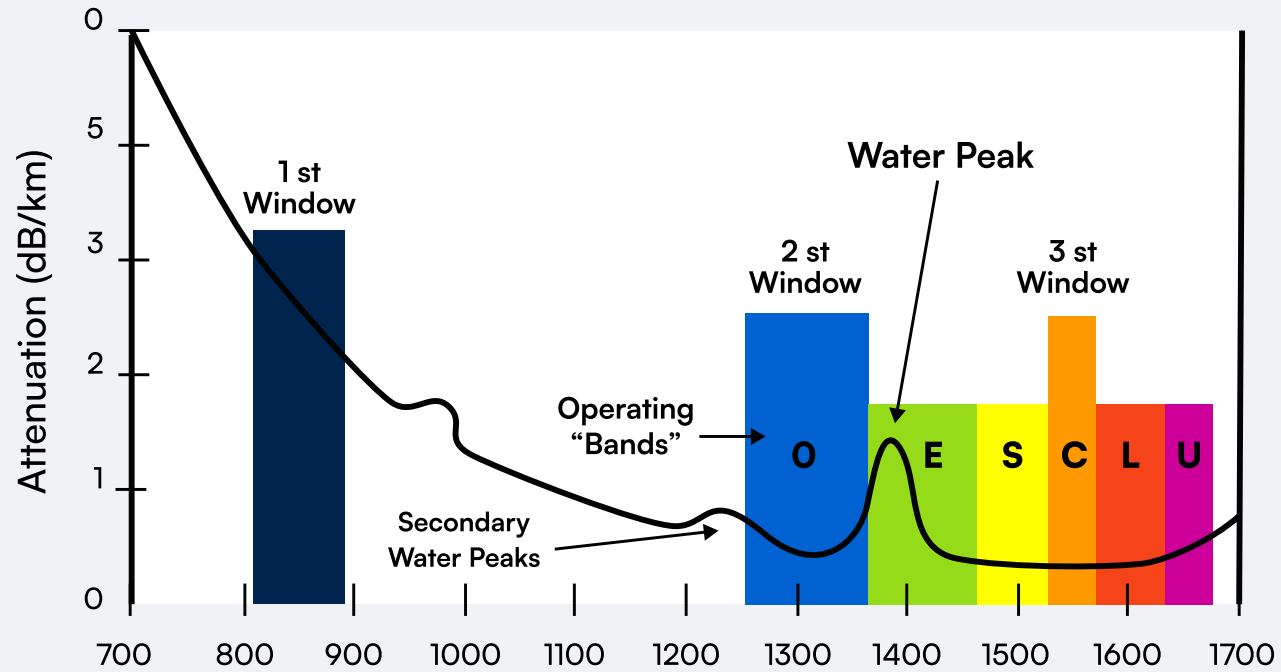
NOG.FI 2024 | Tampere | 6th June 2024

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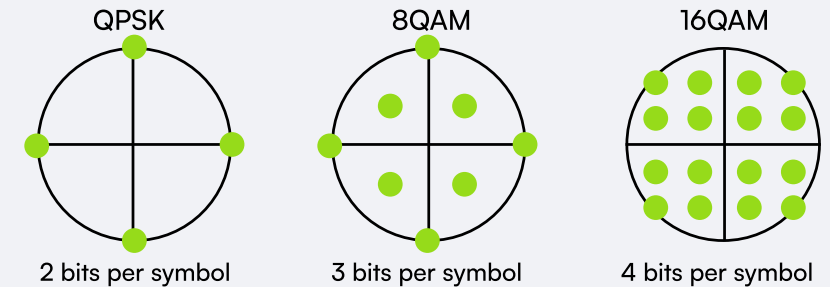
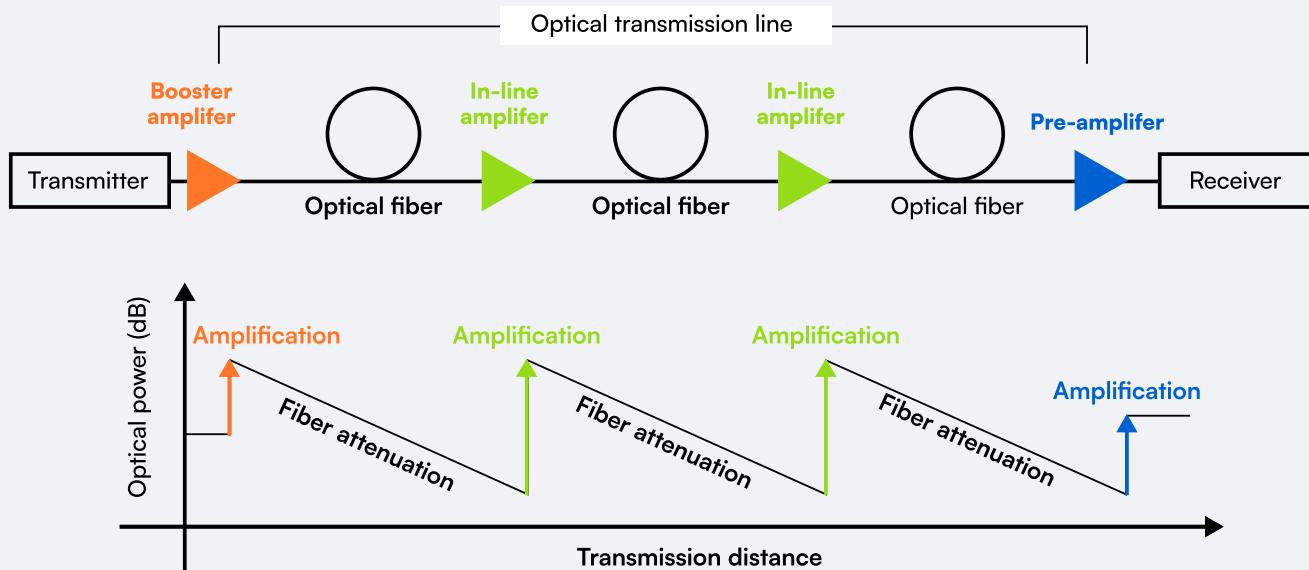
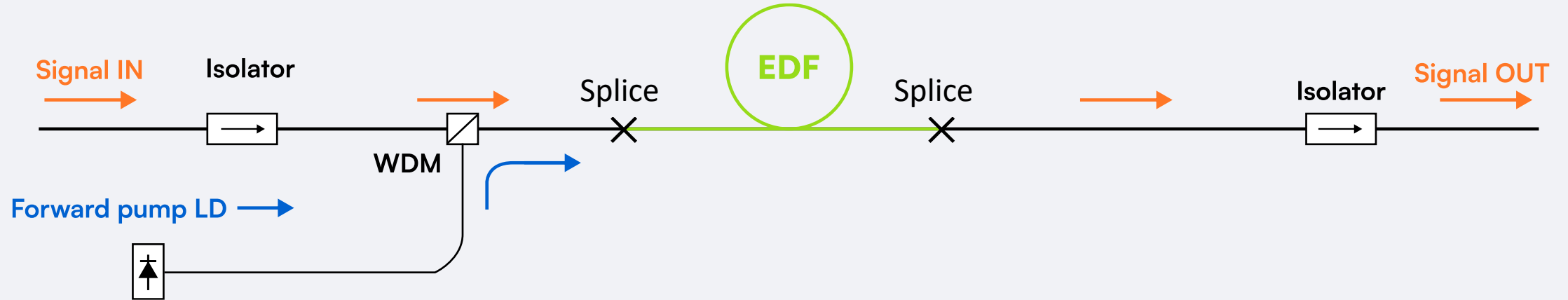
Agenda

- **Extremely short DWDM**
- **The power of O-Band**
- **Still not long distance**
- **Way to 800G**
- **Keep „grey” ready**

WDM introduction

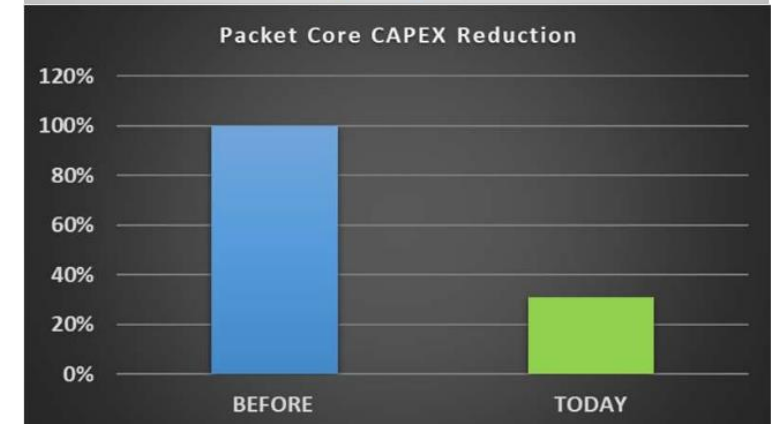
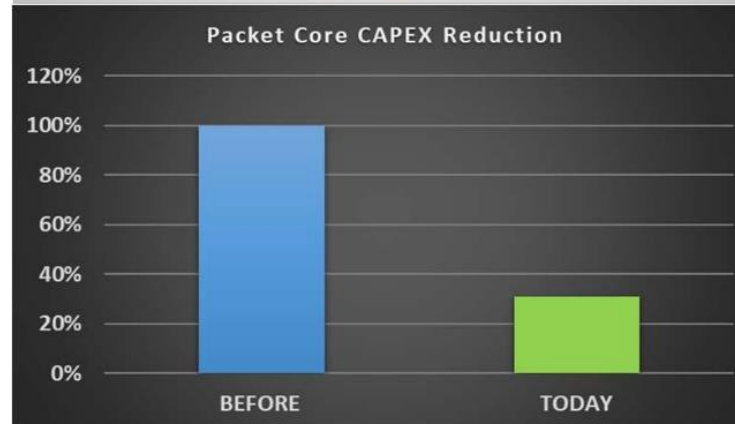
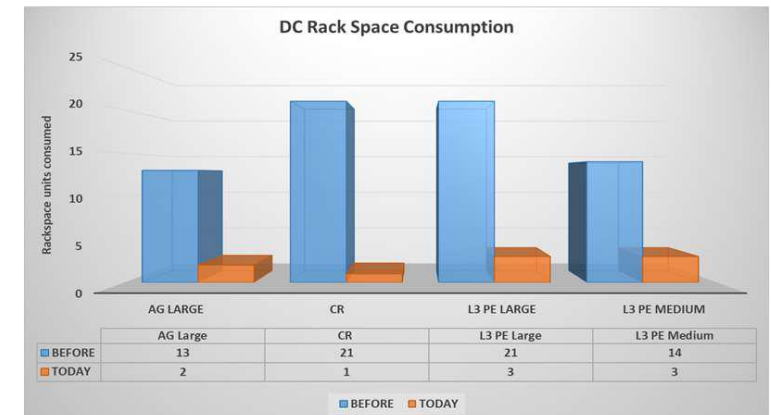
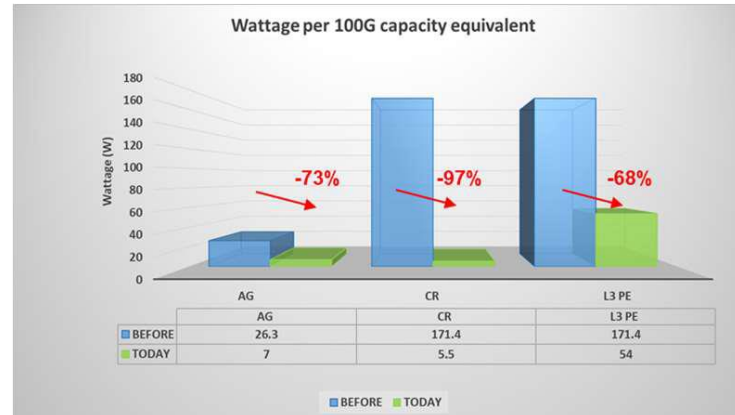


Key moments in WDM development



Traditional VS IPoDWDM

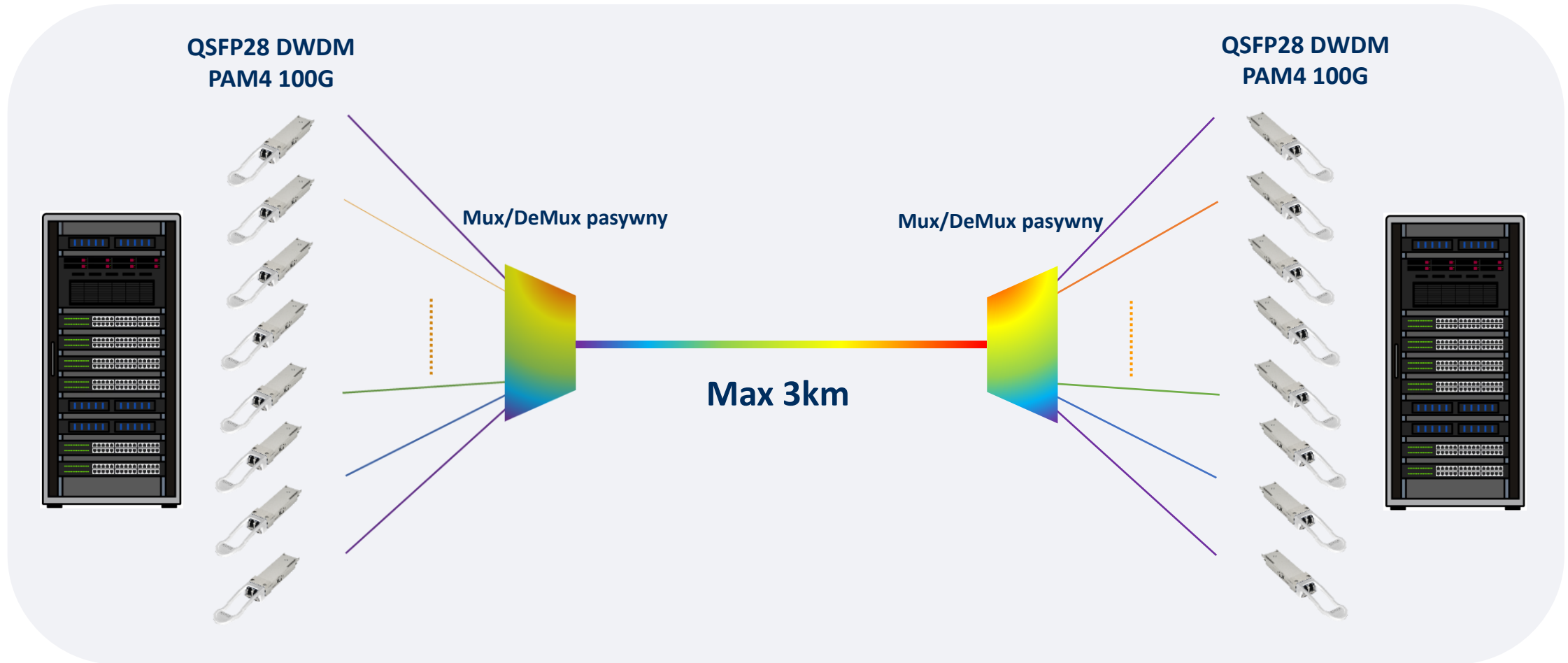
Optic	Reach	Cost (CAPEX)	Power	Space
	km		per 400GE port	
Transponder@800G	150/60	87	140 W	0,17 RU
Transponder@600G	1000/700	100	168 W	0,20 RU
Transponder@400G	2000	121	188 W	0,23 RU
OpenZR+@400G	1040/480	59	58 W	0,11 RU
OpenZR+@300G	2300/1600	92	78 W	0,16 RU
400ZR DCI	120/80	47	58 W	0,11 RU



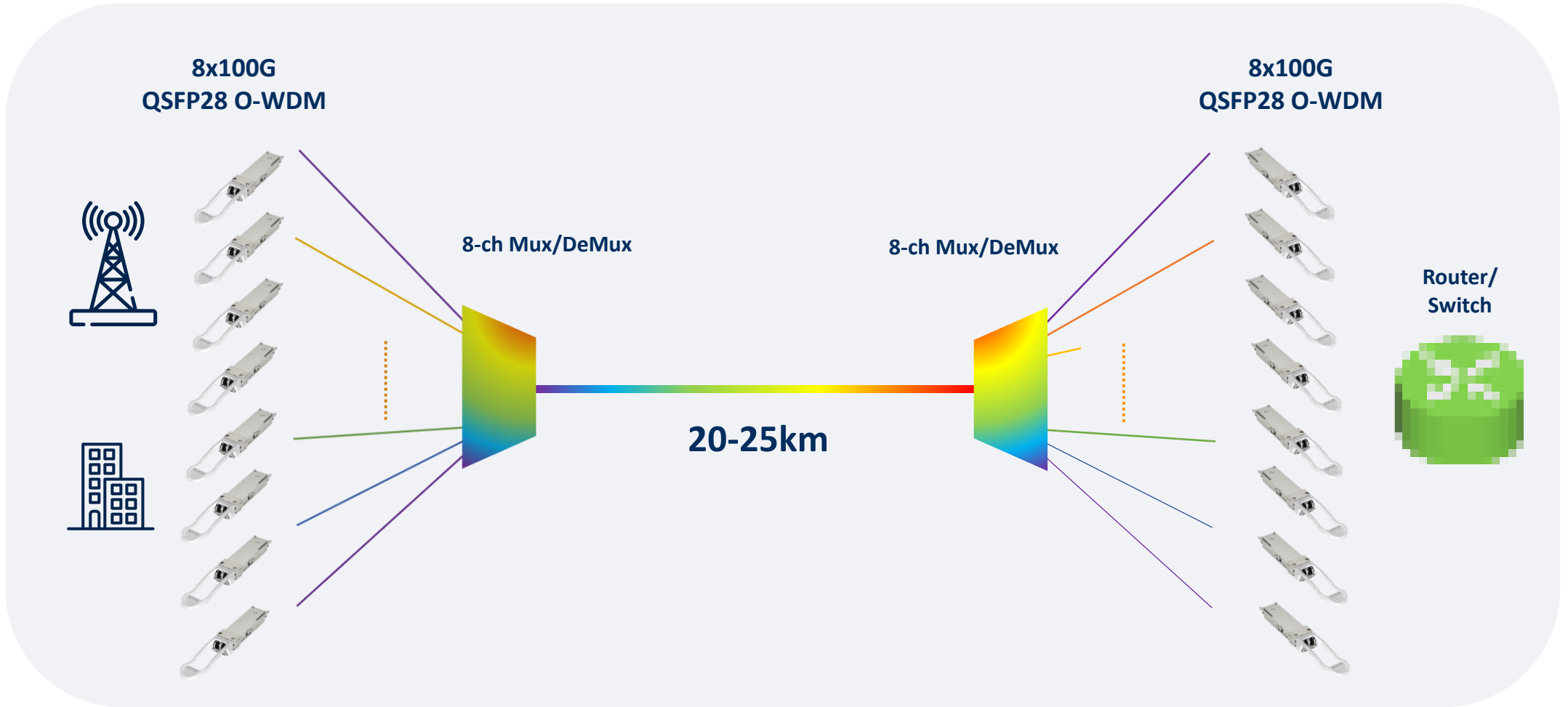
Compatibility QSFP-DD ZR+

- Nokia (7750 SR, OS 22.10.R5, 23.3.R2, 23.10.R1)
- Juniper (PTX, MX, OS 23.1R1.8, 23.4R1)
- Cisco (8201, OS 7.9.1)
- UfiSpace (IP Infusion 6.4.2, DriveNets 18.0.0)
- Edgecore (IP Infusion 6.4.2, DriveNets 18.0.0)
- ... and more

Inside DC - QSFP28 DWDM PAM4

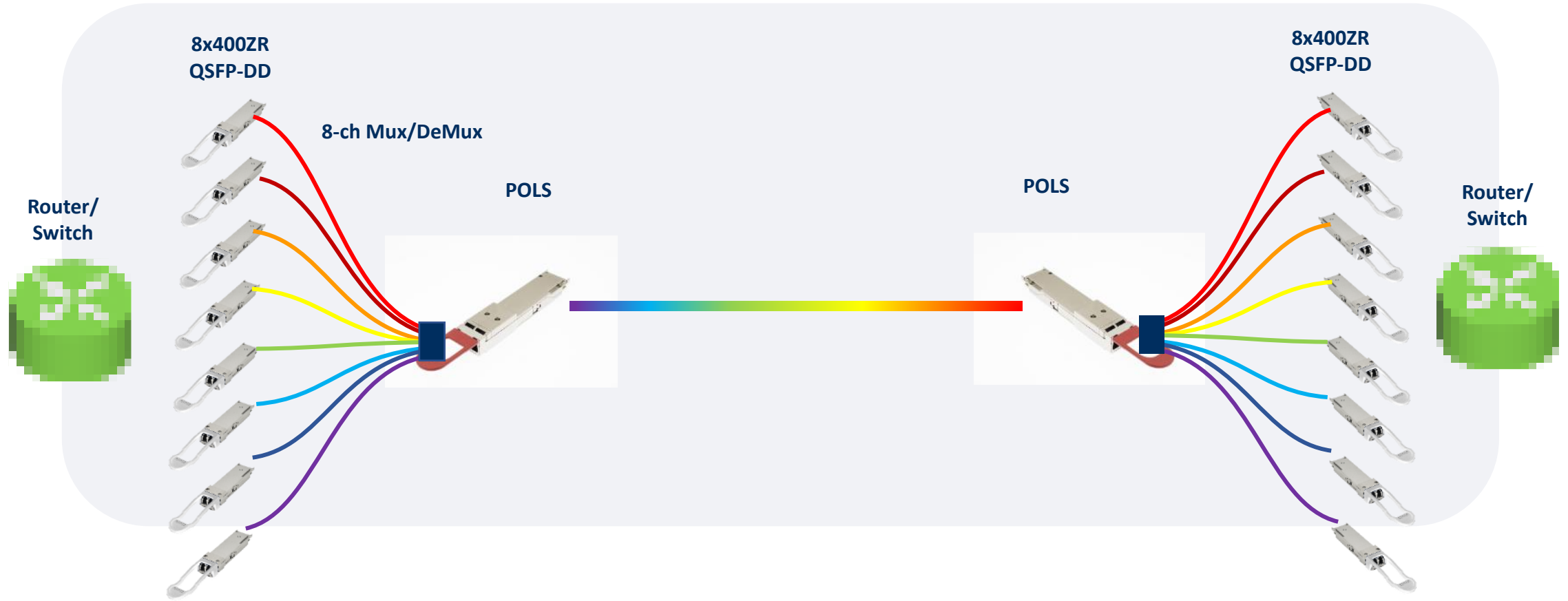


The power of O-Band

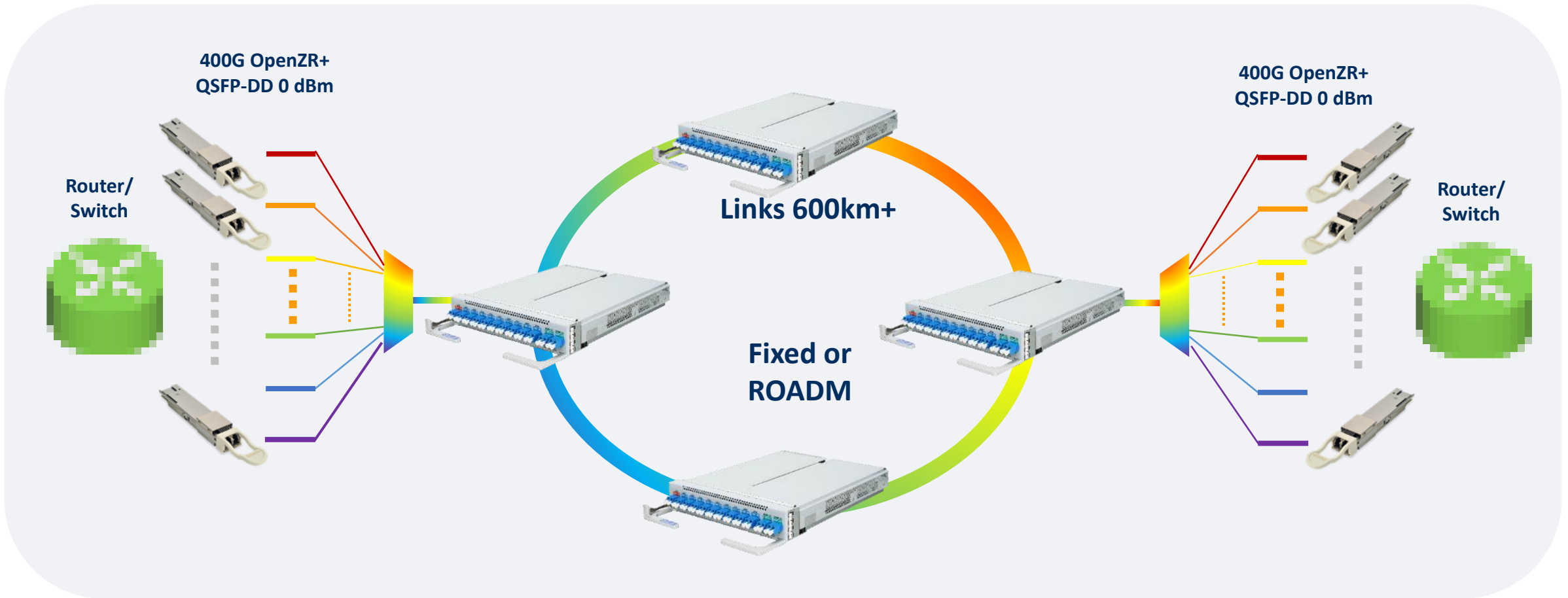


Still not long distance

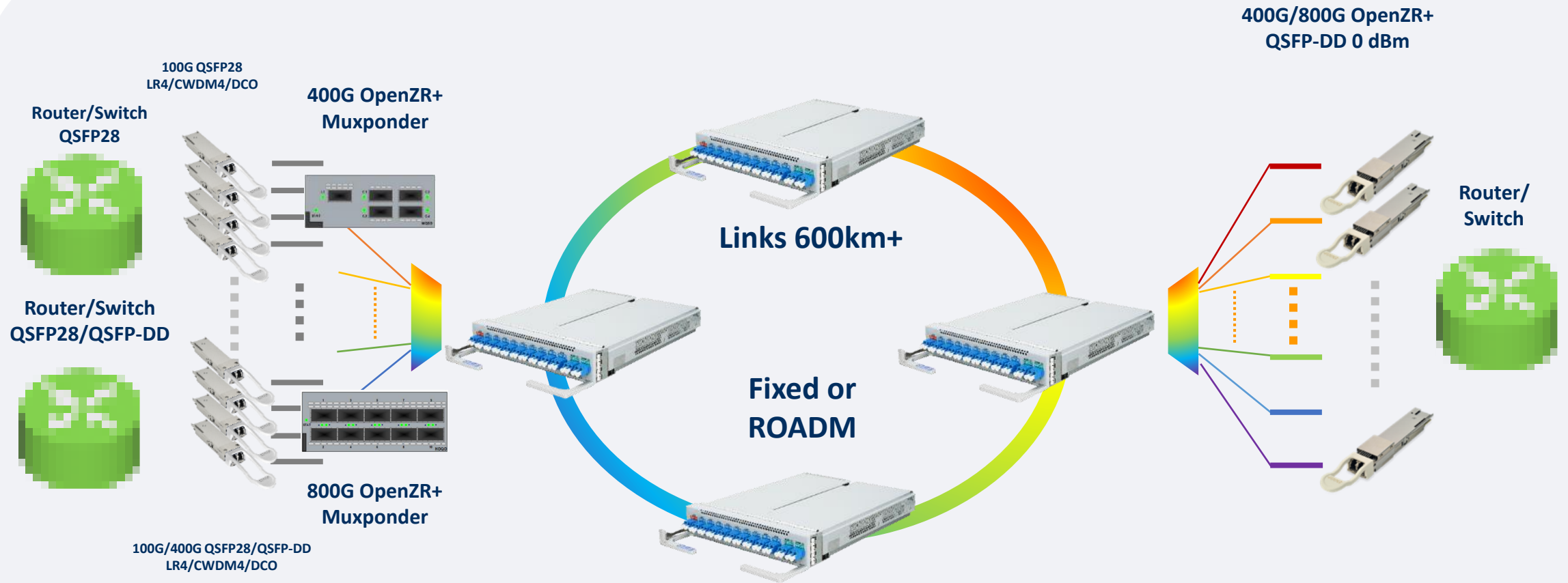
IP-over-DWDM using QSFP-DD 400G ZR/ZR+ & POLS



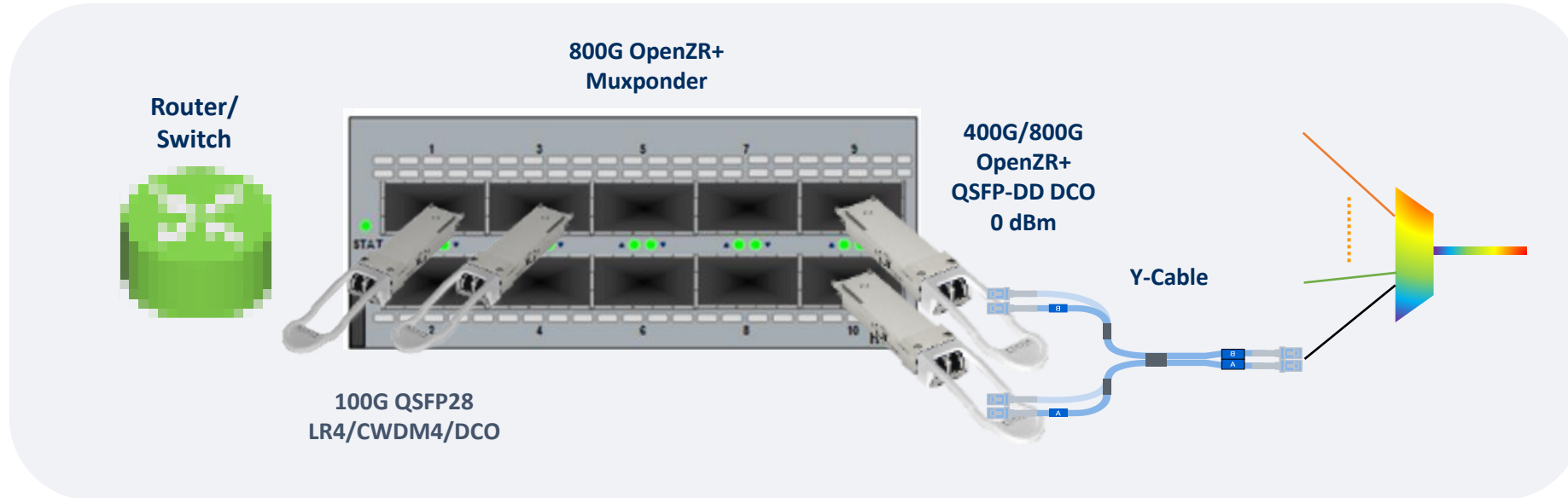
Same transceivers – longer distance



Hybrid solution – IPoDWDM + Muxponder



Way to 800G



QSFP-DD 400G OpenZR+

400Gbps, 16QAM, O-FEC – OSNR 23dB, range up to 600km – throughput 800Gbps

300Gbps, 8QAM, O-FEC – OSNR 20dB, range up to 1000km – throughput 600Gbps

200Gbps, QPSK, O-FEC – OSNR 15dB, range up to 2000km – throughput 400Gbps

100Gbps, QPSK, O-FEC – OSNR 12dB, range up to 4000km – throughput 200Gbps



100G/400G/800G

Direct Detect Transceivers

100G point to point over fiber pair – 1x100G

- QSFP28 FR1 – 2 km
- QSFP28 LR1 - 10 km
- QSFP28 ER1 – 40km (soon)

All transceivers use 1310 nm

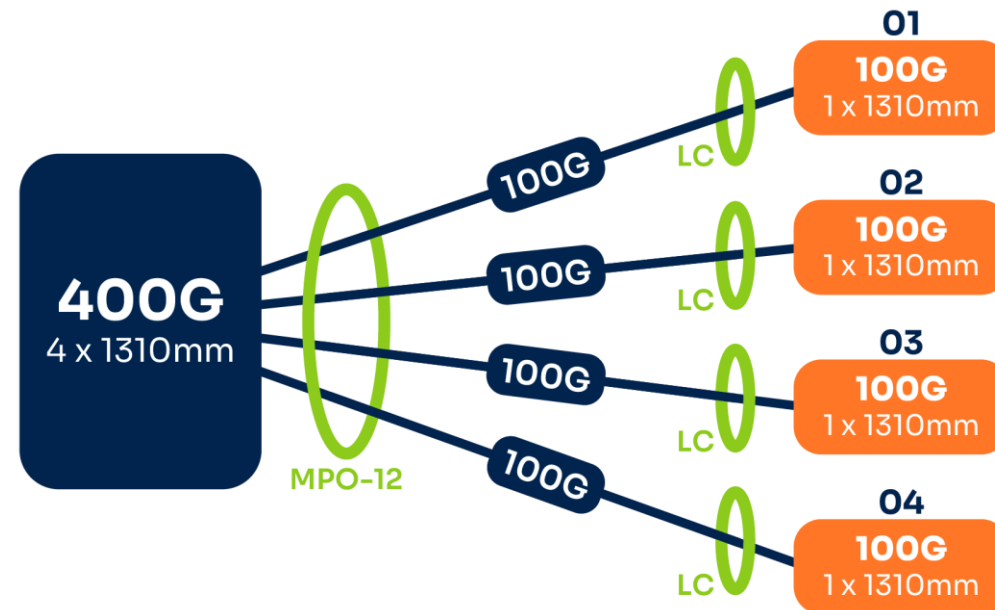
100G/400G/800G

Direct Detect Transceivers

QSFP-DD 4xFR1/4xLR1 – 2km/10 km

MPO12 connector to easy breakout

All use 1310nm



400G to 4x100G point to multipoint

100G/400G/800G

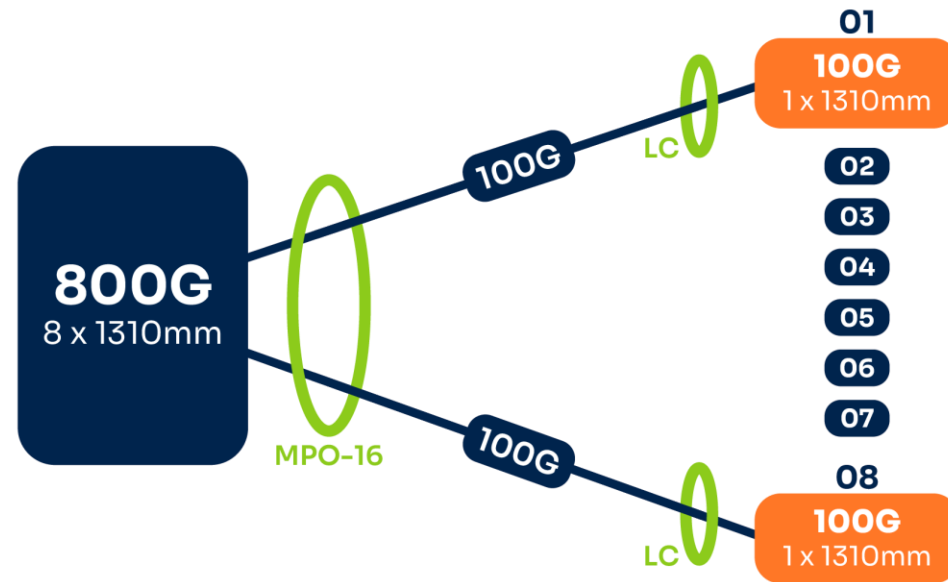
Direct Detect Transceivers

800G to 8x100G point to multipoint

QSFP-DD800 XDR8/PLR8 - 2km/10 km

MPO16 connector to easy breakout

All use 1310nm



100G/400G/800G

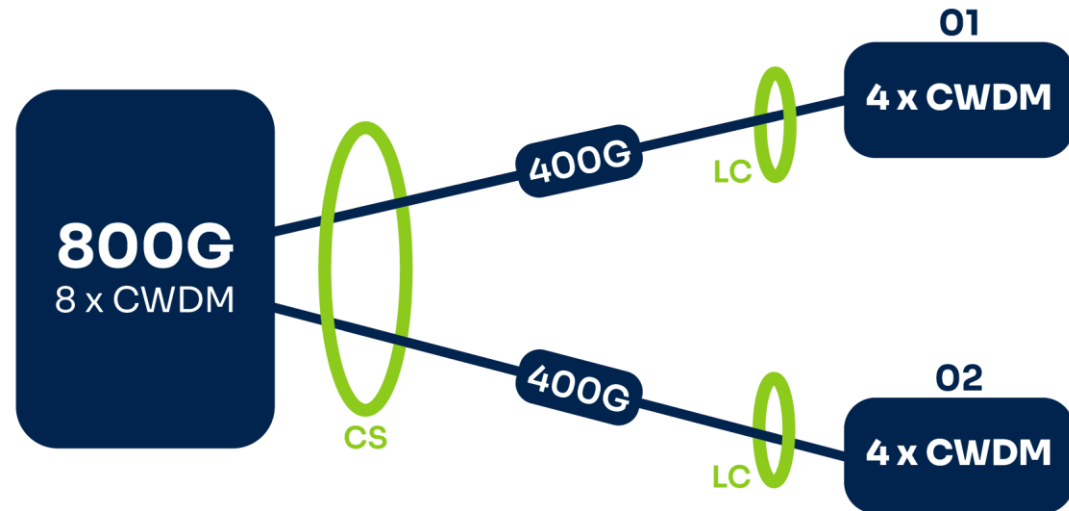
Direct Detect Transceivers

800G to 2x400G point to multipoint

QSFP-DD800 2xFR4/2xLR4 - 2km/10 km

Dual CS connector to easy breakout

All use 1270/1290/1310/1330 nm



Sum Up

- **PAM4 modulation for „grey” plugs**
 - **QSFP28 LR1, QSFP-DD 4LR1, QSFP-DD800-8LR1**
 - **QSFP-DD LR4, QSFP-DD800 2LR4**
- **Simple DWDM**
 - **Inside DC**
 - **Up to 25km**
- **Go Coherent**



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Thank you!



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