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OFC 2026 Live Demo

Power Optimization of **Single-Fiber** Single-Wavelength **Bi-Direction Point-to-Multipoint** with 4 LEAFs

By Strategic, Architecture, and Engineering Team, Nokia Munich

17 – 19 March 2026

OFC 2026, Los Angeles, USA

Allegro

NESTOR DOCTORAL NETWORK

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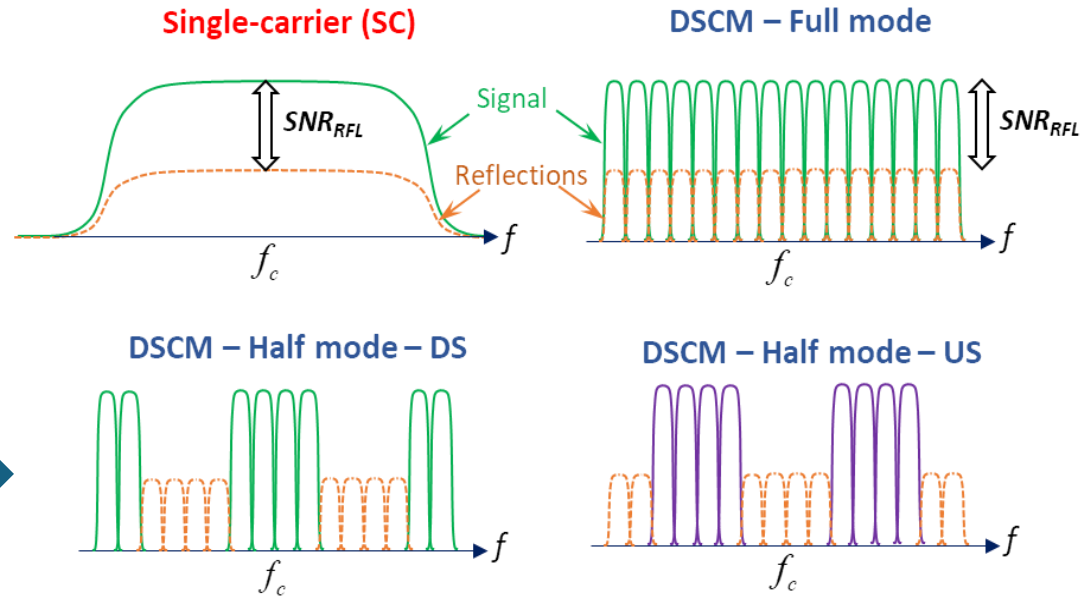
Next generation B5G/6G mobile transport must….

Single- {laser, wavelength, fiber}

- **Why:** Less components, no diff in latency, less fiber
- **How:** Digital subcarrier multiplexing and single laser
- **What:** SW configurable, less CapEx, lessOpEx
- **Challenge:** Single fiber transmission struggles with reflections & backscattering[1,2,3]
  - Current commercial NOKIA solution uses digital subcarrier multiplexing with frequency interleaving



In this demo: We double capacity via power optimization model with accurate performance prediction

[1] https://mopa-alliance.org/; [2] P. Torres-Ferrera et al, OFC 2024; [3] P. Torres-Ferrera et al, ECOC 2024

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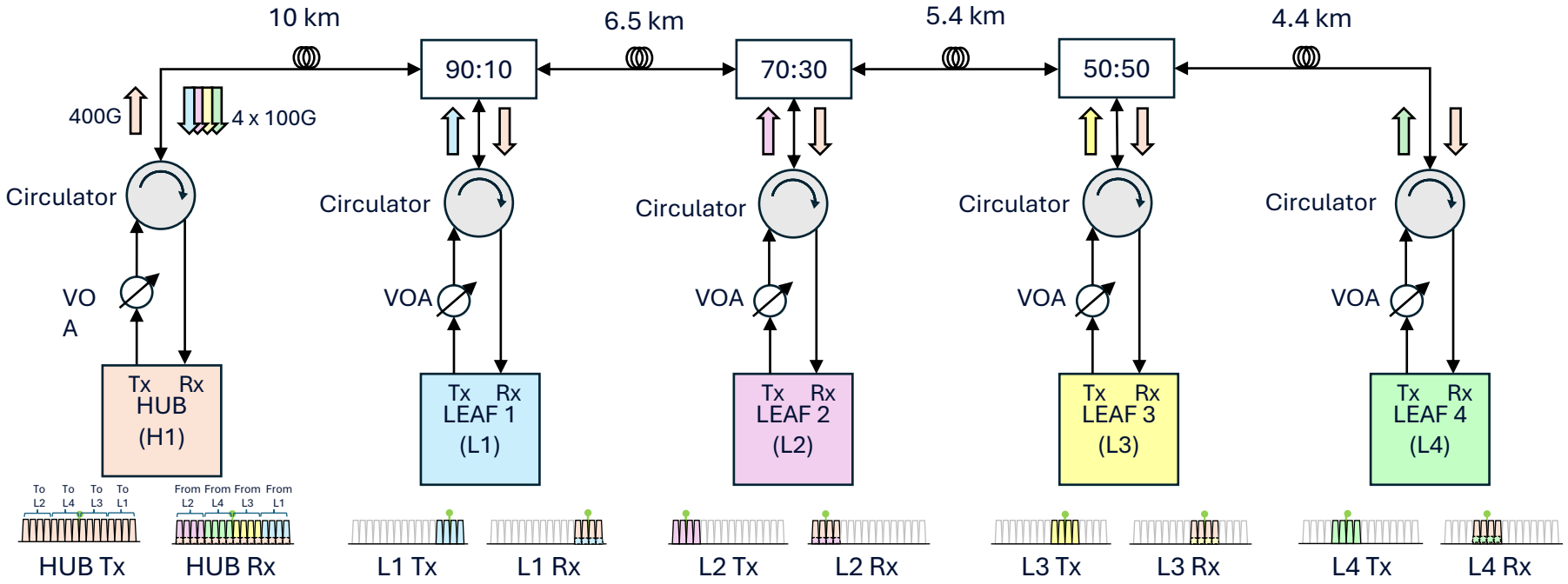
*Product **guarantees** 200G and operationally 200G if circumstances align
200G Guaranteed + 200G noncommitted

Experimental Setup



Module laser

Configuration of the TRXs:

- The **HUB** is a 400G device with 16 DSCs per direction.
- Each **LEAF** is a DP-16QAM 100G device operating with 4 DSCs (25G each) per direction.

Single-Fiber Single-Wavelength Bidirectional Digital Subcarrier Point-to-Multipoint Coherent Systems for Beyond 5G Transport

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P2MP: Point-to-Multipoint
DSC: Digital Subcarriers
VOA: Variable Optical Attenuator

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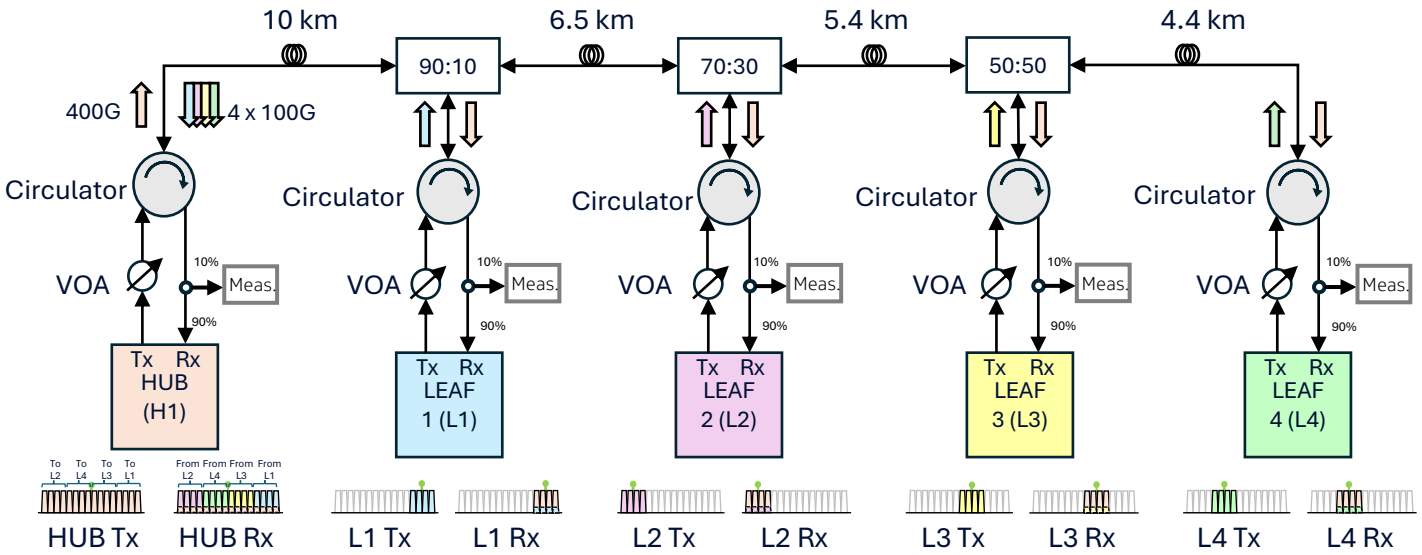
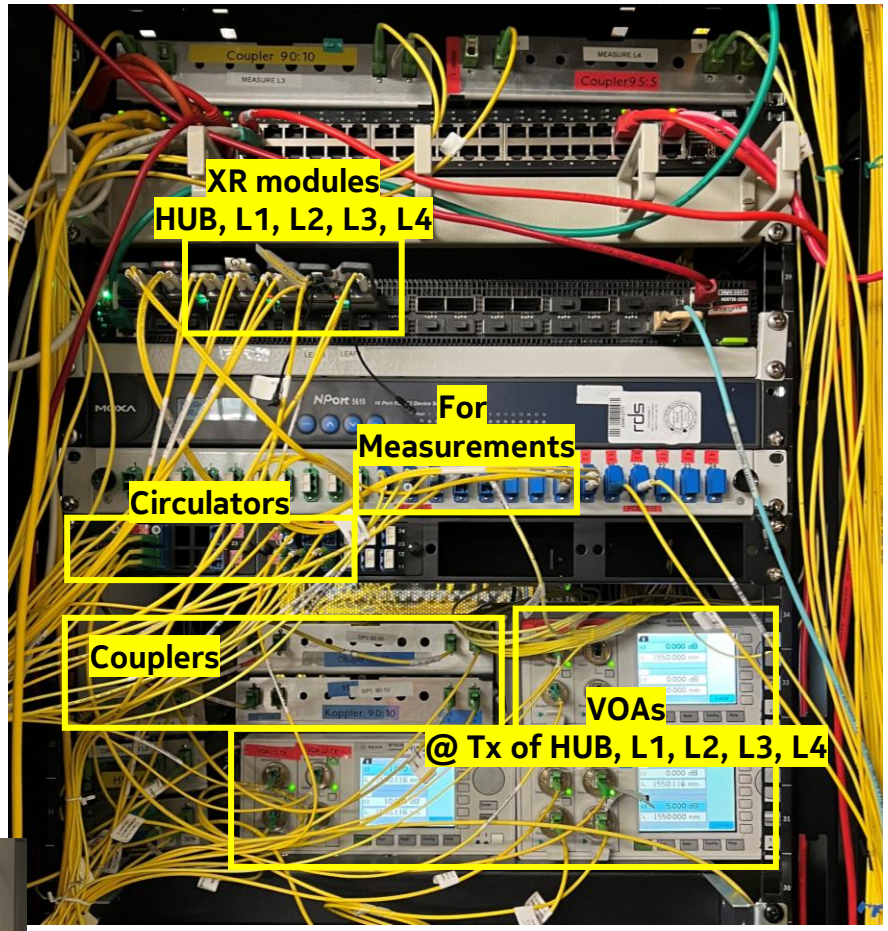
LAB – Setup Overview





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Starting with Point-to-Point

- **Theoretical model:** (BER and SNR relationship)

SNR_{TRX}: Transceiver intrinsic noise

SNR_{LR}: Discrete reflections

$$\frac{1}{SNR} = \underbrace{\frac{1}{SNR_{ASE}} + \frac{1}{SNR_{RB}} + \frac{1}{SNR_{LR}}}_{GSNR^{-1}} + \frac{1}{SNR_{TRX}}$$

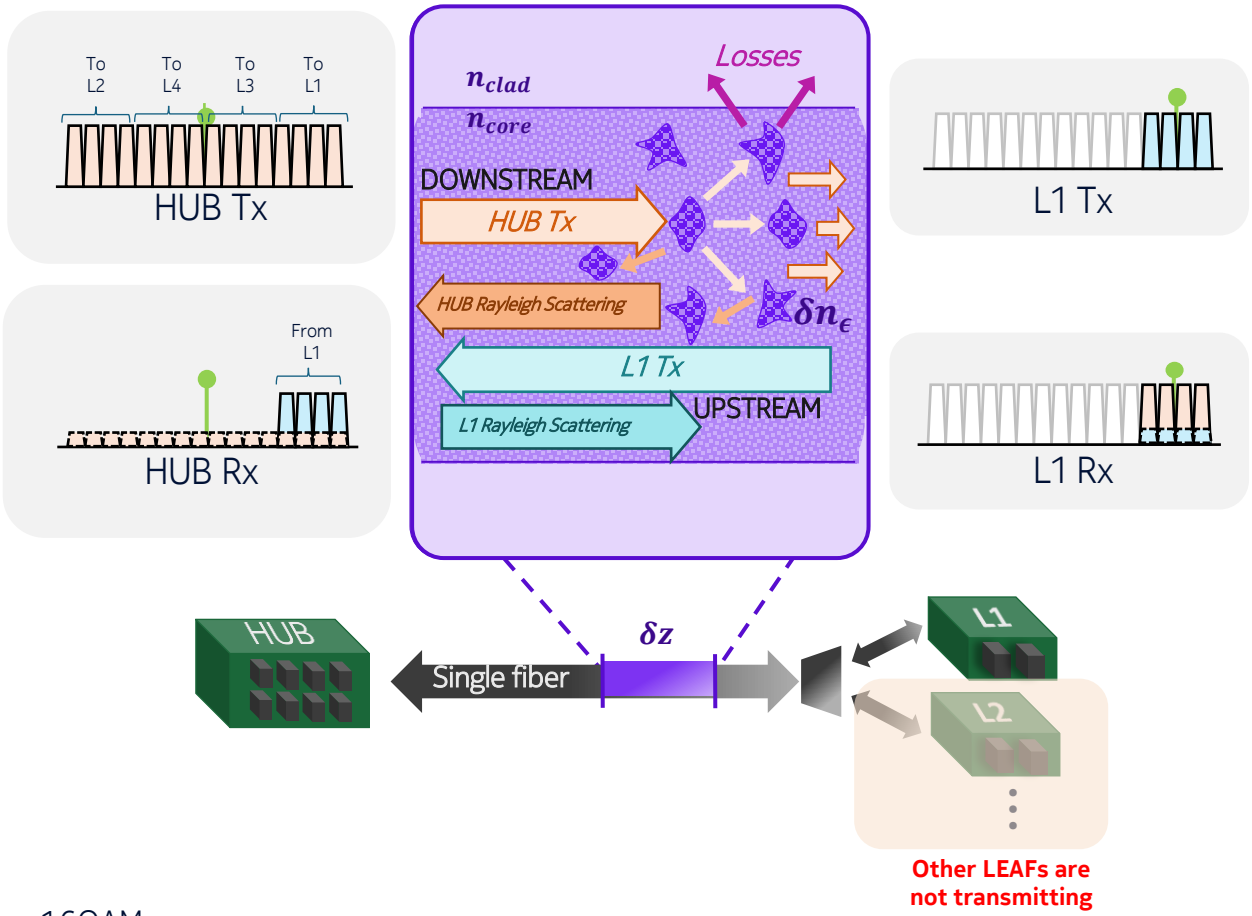
- **Rayleigh Back-Scattering:** (HUB ⇄ LEAF 1)

$$SNR_{RB} = \frac{P_{RX}^{(L_1 \to HUB)}}{P_{RB}} = \frac{P_{RX}^{(L_1 \to HUB)}}{A_{loss}\left(2S\alpha_R \frac{1 - e^{-4\alpha d}}{4\alpha}\right) P_{TX}^{(HUB \to L_1)}}$$

- From total SNR, we can find the relationship with BER:

$$BER = \psi(SNR) \qquad \psi(SNR) = \frac{3}{8}\,\mathrm{erfc}(\sqrt{x/10})$$

For 16QAM



α = Fiber Loss
α_R = Rayleigh Constant
d = Fiber distance

A_s : Total system loss
A_c : Circulator loss

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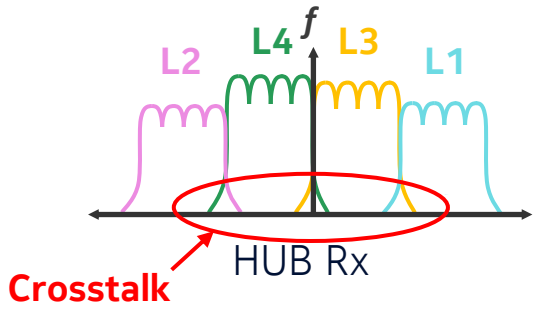
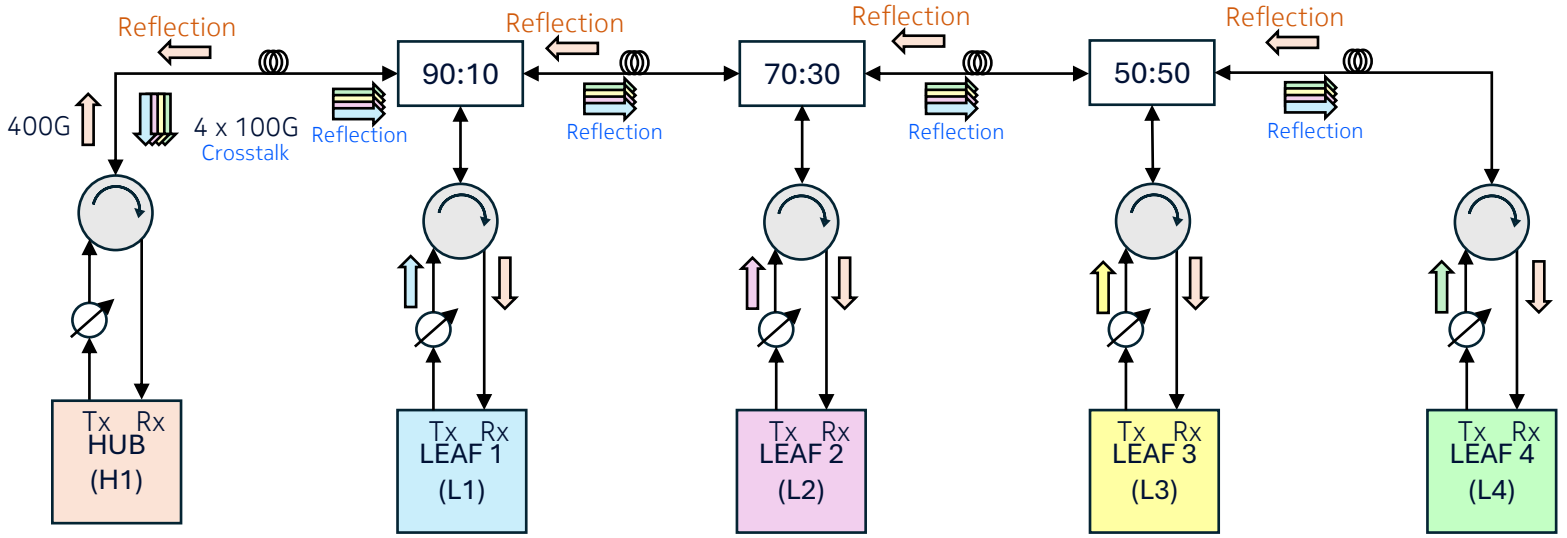
Moving to Point-to-Multipoint

Analytical QoT Model for Bi-Di Single-Fiber Point-to-Multipoint DSCM Coherent Systems

Esteban Paz[1,2,*], Giuseppe Parisi[1], Pablo Torres-Ferrera[1], Tiago Silvério[1,2], Sasipim Srivallapanondh[1], Miquel Masanas[1], Luis Velasco[2], M. Sezer Erkilinç[3], Roberto Magri[4] and Antonio Napoli[1]





- Three (flat) noise sources are taken into account:
  1. Transceiver Noise N_{TRX}
  2. Reflection Noise N_{RB}
  3. Xtalk Noise N_{XT}

$$\frac{1}{SNR} = \frac{1}{GSNR} + \frac{1}{SNR_{TRX}} + \boxed{\frac{1}{SNR_{XT}}}$$

$$BER = \psi(SNR) \qquad \psi(SNR) = \frac{3}{8}\,\mathrm{erfc}\left(\sqrt{x/10}\,\right)$$ For 16QAM

LR: lumped reflections
TRX: Transceiver

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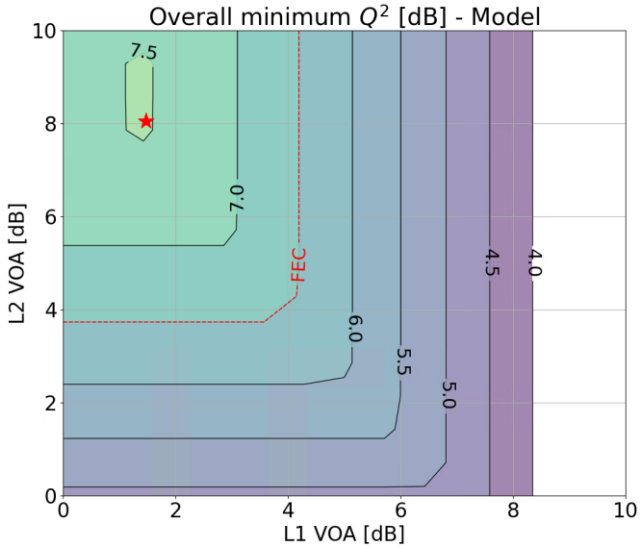
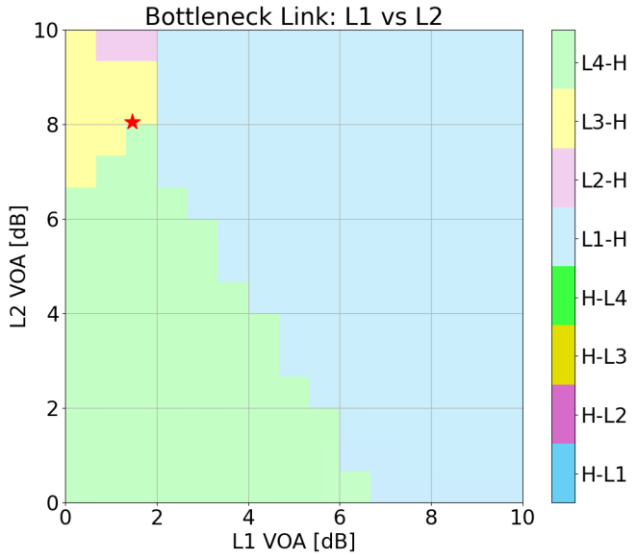
Understanding the Demo

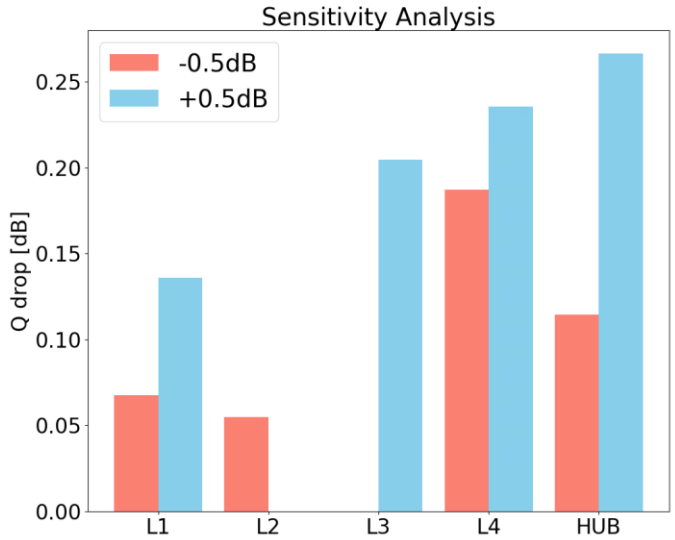
- We use the Q-factor as the metric



Overall minimum Q^2 of all the links (To ensure we get at least x dB of Q)



To show which link is giving the minimum Q (Uplink: light colors, Downlink: dark colors)



To show if the Tx power of each LEAF drifts by ±0.5 dB, how much Q will be affected

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P2MP Network Optimization Dashboard

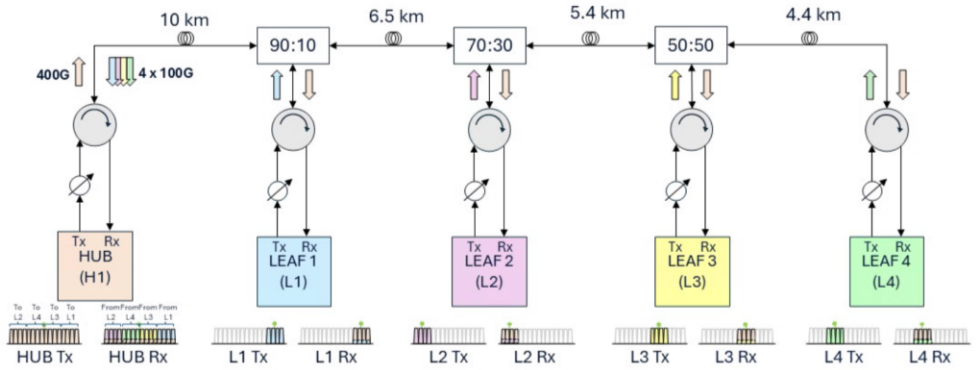
Configure Fixed Attenuation (VOA) Settings

VOA at HUB Tx (dB)	VOA at L1 Tx (dB)	VOA at L2 Tx (dB)	VOA at L3 Tx (dB)	VOA at L4 Tx (dB)
None	OFF	None	None	None

Optimization Mode

(•) Maximize Overall Minimum Q ( ) Minimize Tx Power with Target Q (dB) 6,90 Set Values

Link Performance - Q Factor (dB)



L1-H

OFF

H-L1

OFF

H-L2

10.70	10.31	10.19	10.23
10.63	10.25	10.13	10.18
0.7%	0.7%	0.8%	0.7%

H-L3

8.95	9.28	9.19	9.13
8.81	9.32	9.10	9.04
0.5%	1.0%	1.6%	1.0%

H-L4

7.70	7.71	8.01	7.79
7.73	7.69	8.01	7.77
0.2%	0.0%	0.4%	0.2%

L2-H

M	7.84	7.84	7.83	7.69
L	7.97	7.91	7.9	7.71
Err	1.5%	0.8%	0%	0.2%

L3-H

M	7.87	7.73	7.77	7.74
L	8.31	8.09	8.1	8.05
Err	5.2%	4.2%	4%	3.7%

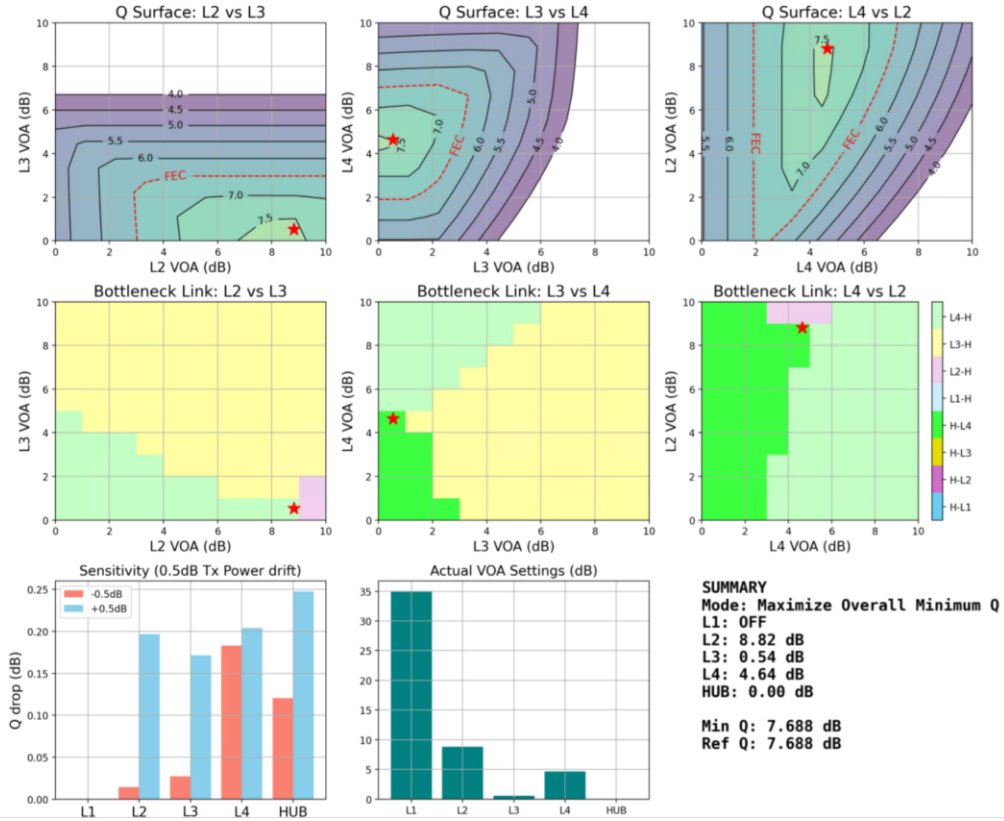
L4-H

Suggested VOA Values

Optimization Mode	VOA HUB Tx (dB)	VOA L1 Tx (dB)	VOA L2 Tx (dB)	VOA L3 Tx (dB)	VOA L4 Tx (dB)	Minimum Q (dB)
Maximize Overall Minimum Q	0.00	OFF	8.82	0.54	4.64	7.69
Minimize Tx Power	3.80	OFF	10.00	5.00	8.40	6.90

Physical VOA values updated in lab!

Analytical Dashboard



SUMMARY
Mode: Maximize Overall Minimum Q
L1: OFF
L2: 8.82 dB
L3: 0.54 dB
L4: 4.64 dB
HUB: 0.00 dB

Min Q: 7.688 dB
Ref Q: 7.688 dB

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OFC 2026 Live Demo #2

Real-time demonstration of 25G-granularity coherent point-to-multipoint, featuring automatic Q-based power control & hitless capacity upgrade

By Strategic, Architecture, and Engineering Team, Nokia Munich

17 – 19 March 2026

OFC 2026, Los Angeles, USA

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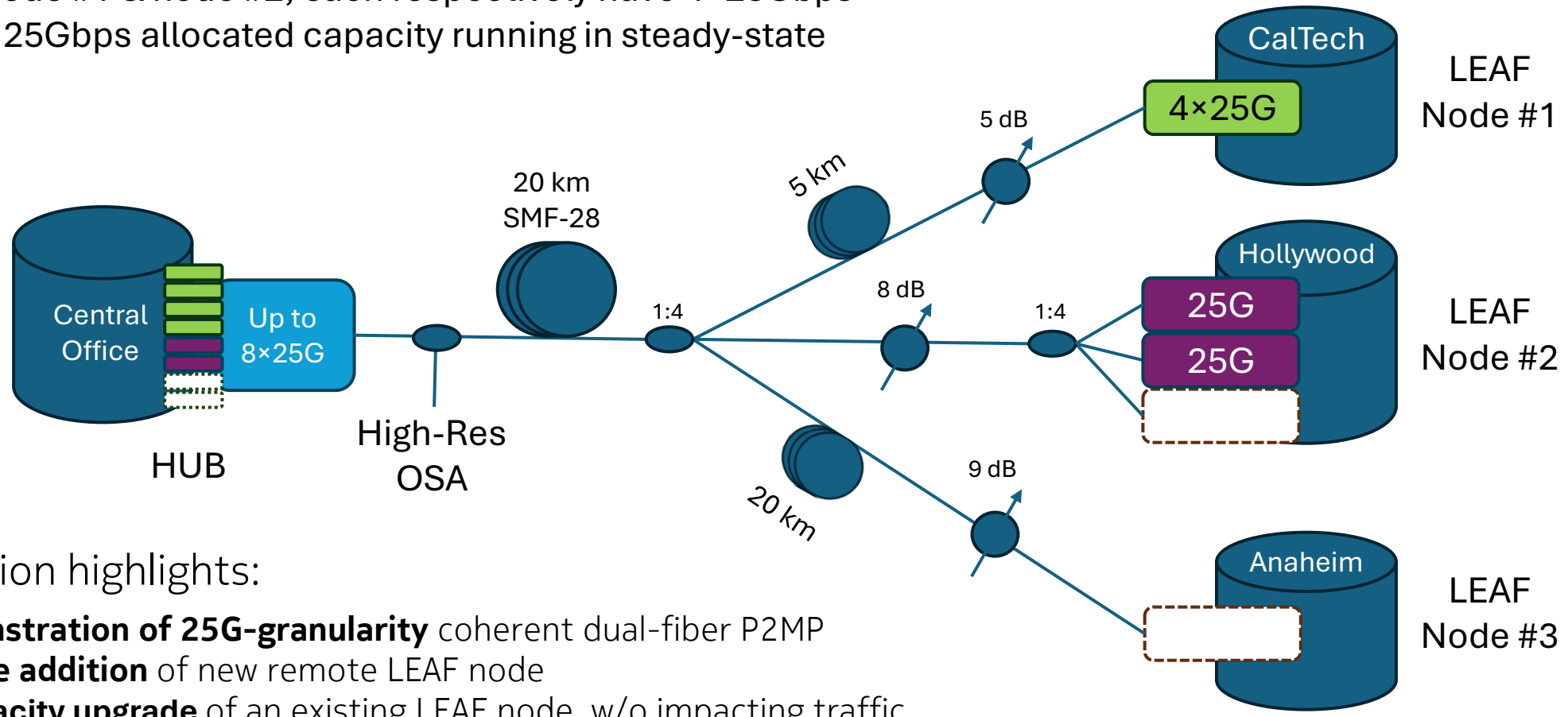
Initial Condition:

- LEAF node #1 & node #2, each respectively have 4×25Gbps and 2×25Gbps allocated capacity running in steady-state

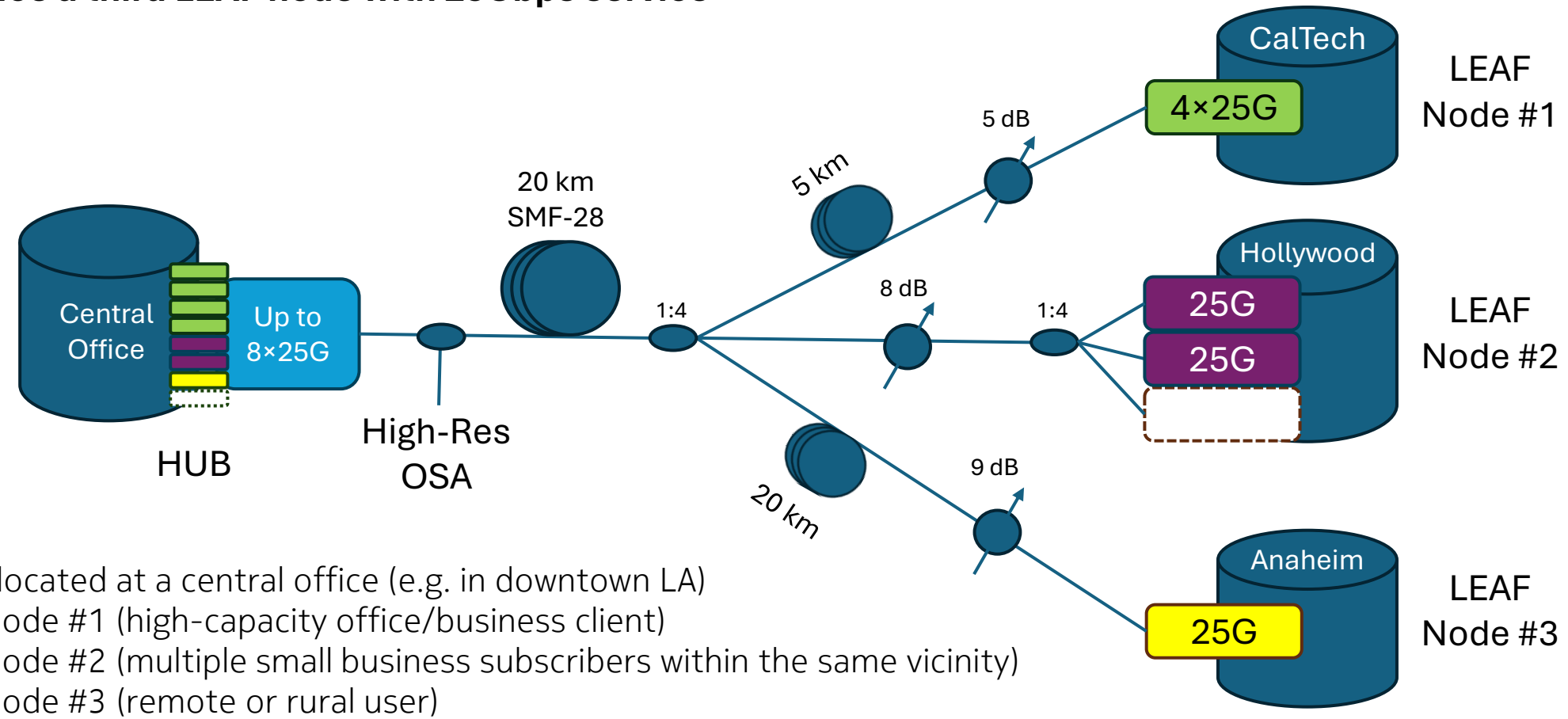


Demonstration highlights:

- **First demonstration of 25G-granularity** coherent dual-fiber P2MP
- **Hitless node addition** of new remote LEAF node
- **Hitless capacity upgrade** of an existing LEAF node, w/o impacting traffic
- **Pre-FEC Q-based automatic Tx power control**, compensating for path loss differences from various LEAFs and controlled introduction of DSCs
- **200G within a 50GHz AWG passband** (fully-populated 8×25Gbps constellation)

Step 1:

- Introduce a third LEAF node with 25Gbps service

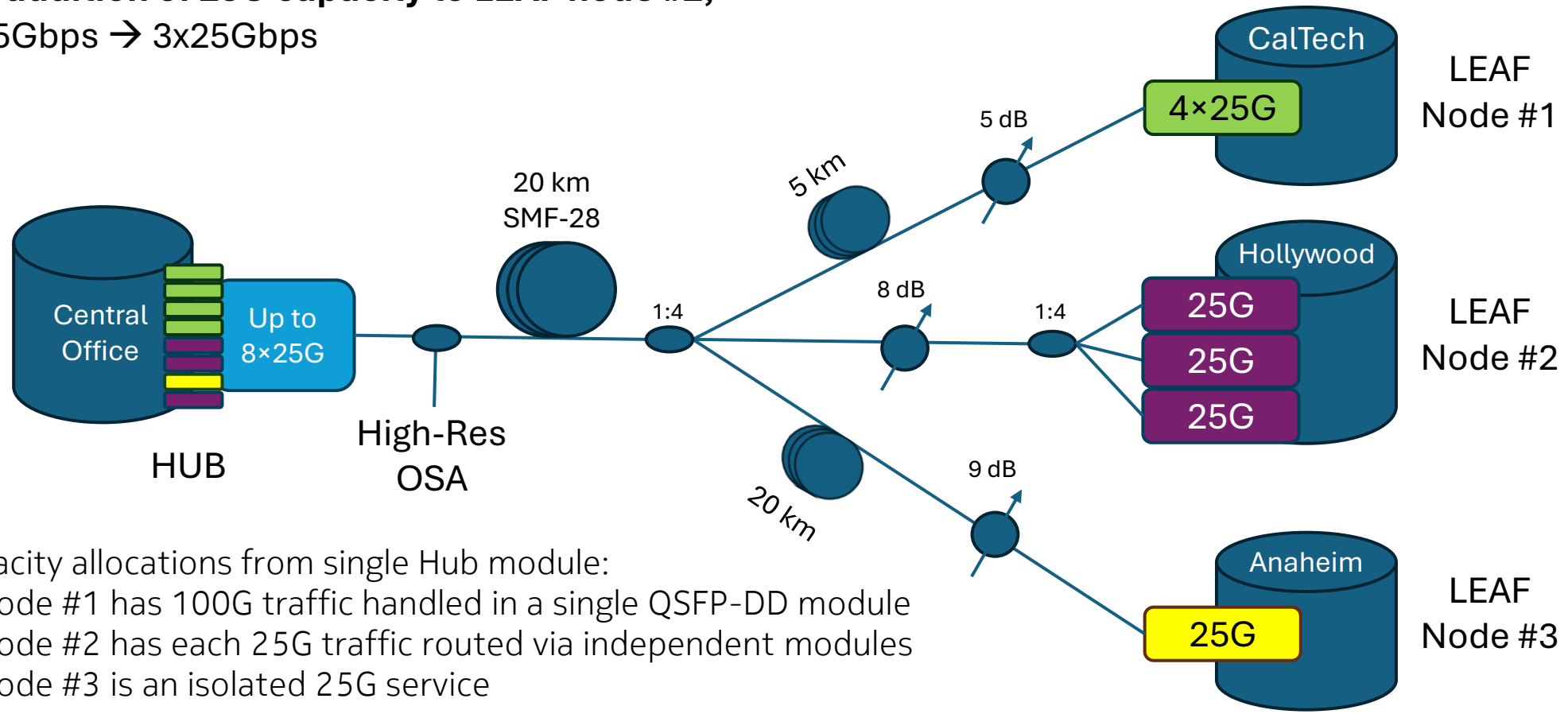


- The HUB is located at a central office (e.g. in downtown LA)
  - LEAF node #1 (high-capacity office/business client)
  - LEAF node #2 (multiple small business subscribers within the same vicinity)
  - LEAF node #3 (remote or rural user)

- Plug-n-play
  - **LEAF node #3 is auto-discovered, assigned service, and auto-power-controlled by the HUB**

Step 2:

- Hitless addition of 25G capacity to LEAF node #2,
i.e. 2x25Gbps → 3x25Gbps

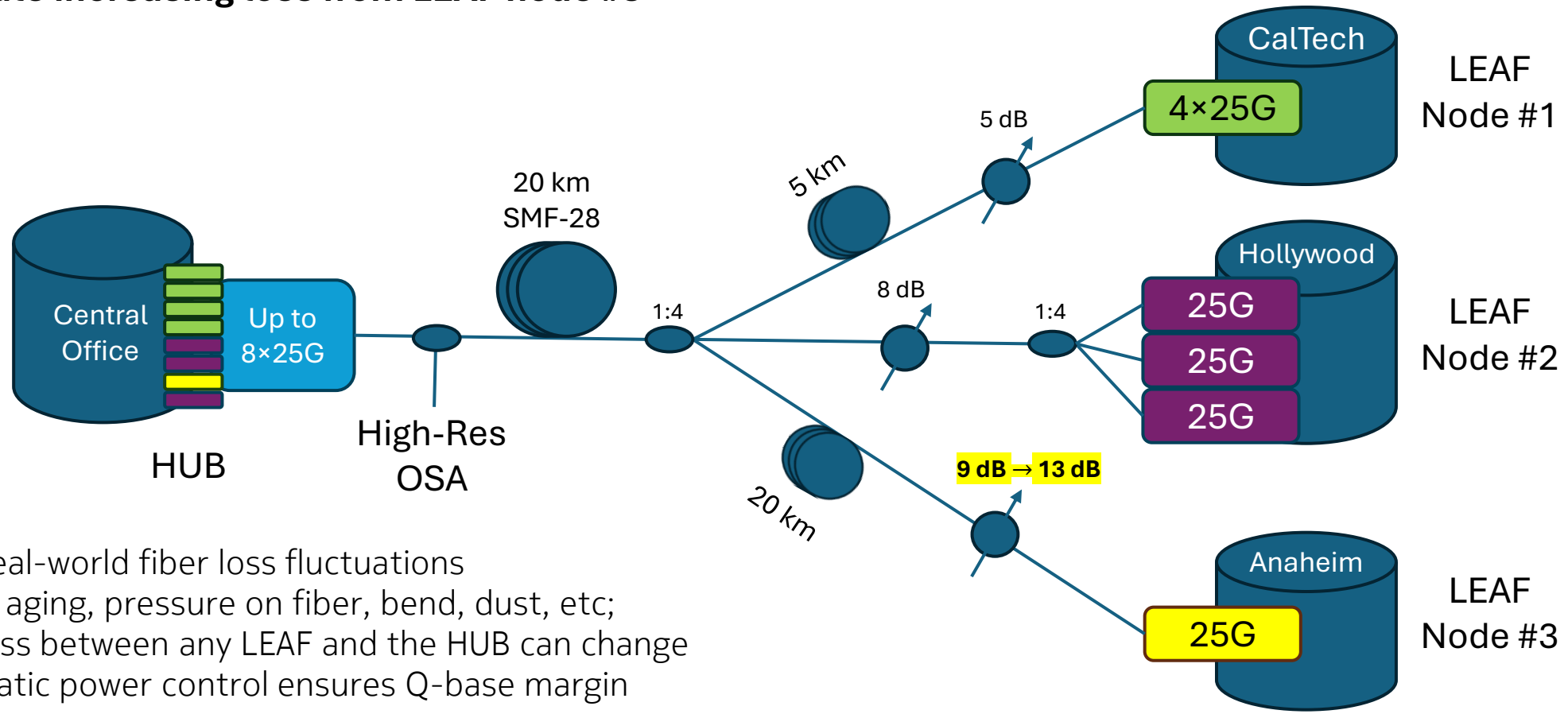


- Various capacity allocations from single Hub module:
  - LEAF node #1 has 100G traffic handled in a single QSFP-DD module
  - LEAF node #2 has each 25G traffic routed via independent modules
  - LEAF node #3 is an isolated 25G service

- HUB based allocation and orchestration of 25G services to independent sites
  - **Auto-discovery, service assignment, DSC allocation**
  - **Pre-FEC Q-based Automatic Tx power control of all DSCs**

Step 3:

- **Emulate increasing loss from LEAF node #3**



- Emulating real-world fiber loss fluctuations
  - Due to aging, pressure on fiber, bend, dust, etc;
  - Path loss between any LEAF and the HUB can change
  - Automatic power control ensures Q-base margin

- Path loss fluctuation is emulated via the VOA in arm 3
  - **Pre-FEC Q-based Automatic Tx power control of all DSCs**

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Switch to web-GUI & run the 3 steps of our live demo

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Thank you for visiting from the team!

Strategic, Architecture, and Engineering Team
Nokia, Munich, Germany

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Demo 1

End to end optical networking

Multi-haul

telecommunication provider networks from access, metro, core/LH to subsea

DCI

Data Center Interconnect solutions from metro to subsea

QSN

Quantum Safe Networking from edge to core

1GE to 800GE

End to end services PON, Optical, IP

PON

Broadband access networks with seamless support of XGS-PON, 25G PON and 50G PON

Single Fiber

200G single fiber working solutions

Coherent breakout

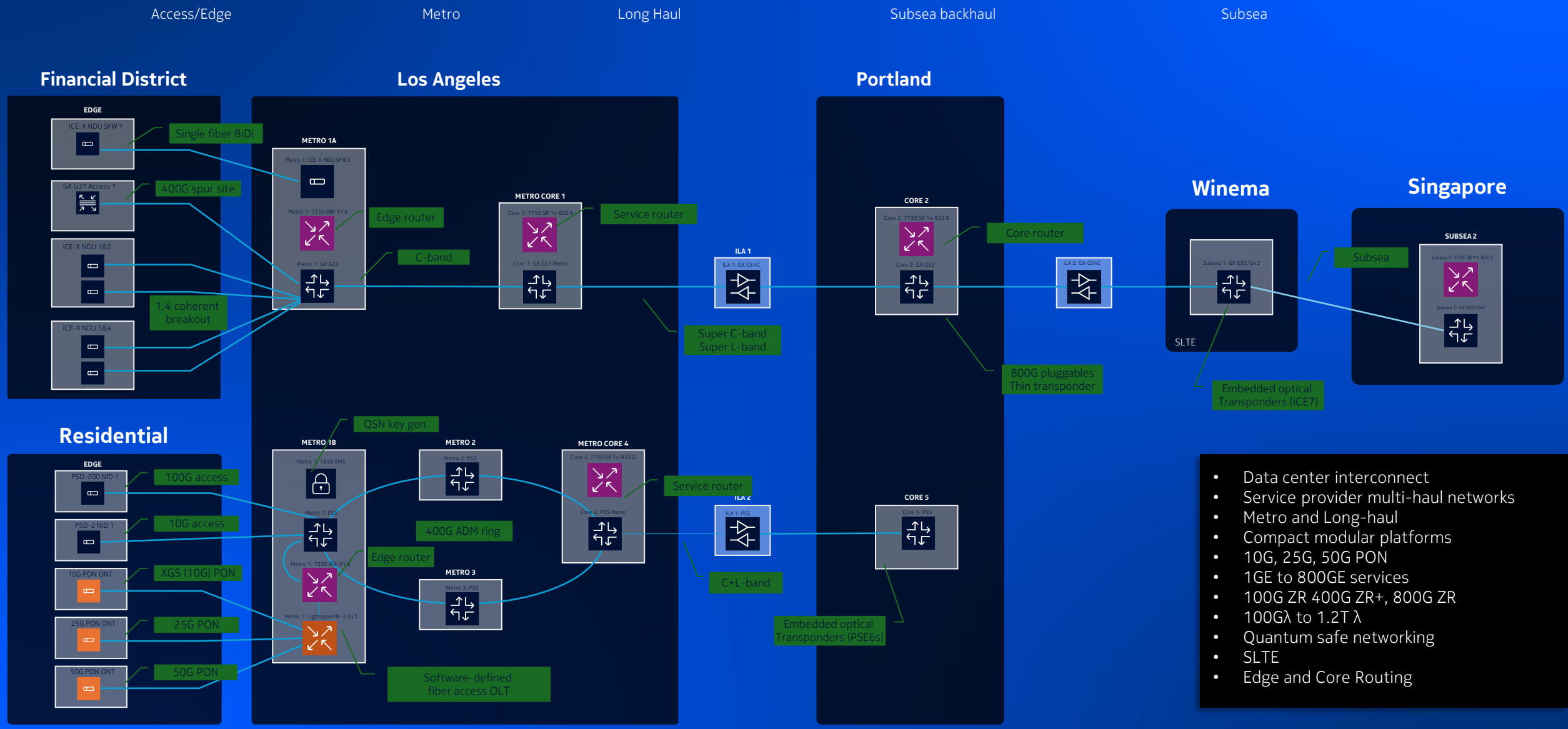
4x 100G to 400G coherent

Coherent Optics

100G ZR, 400G ZR+, 800G ZR

Line Systems

Access, Metro, Long-haul, Subsea
C, Super C, C+L, Super C+L



- Data center interconnect
- Service provider multi-haul networks
- Metro and Long-haul
- Compact modular platforms
- 10G, 25G, 50G PON
- 1GE to 800GE services
- 100G ZR 400G ZR+, 800G ZR
- 100Gλ to 1.2T λ
- Quantum safe networking
- SLTE
- Edge and Core Routing

Demo locations