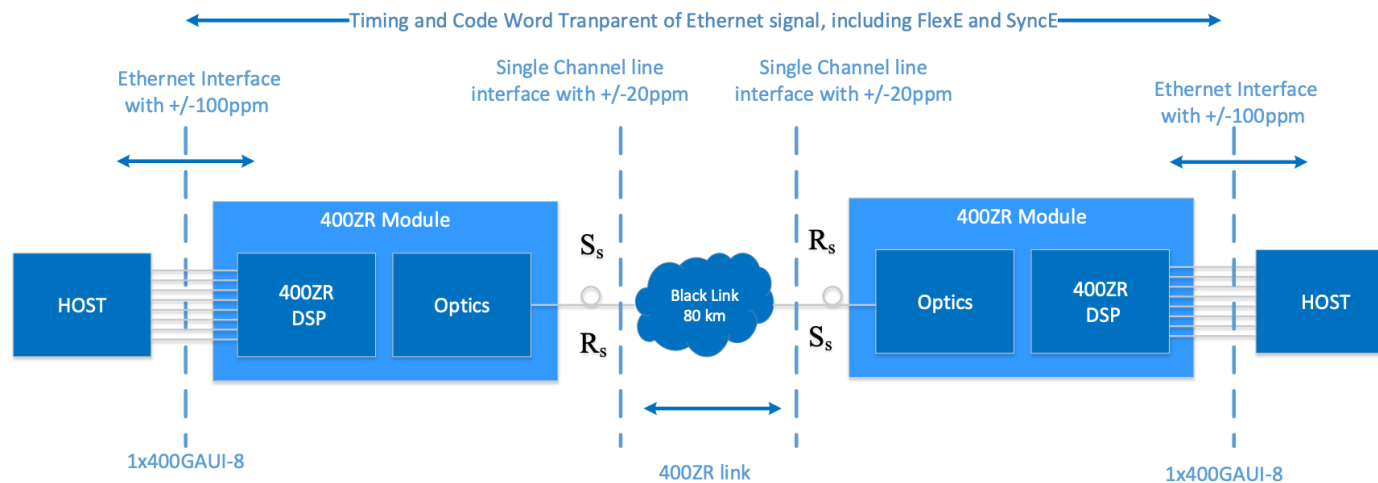


400ZR, OpenZR+, 800ZR, OpenROADM/ITU-T Interoperability Demo OFC 2024

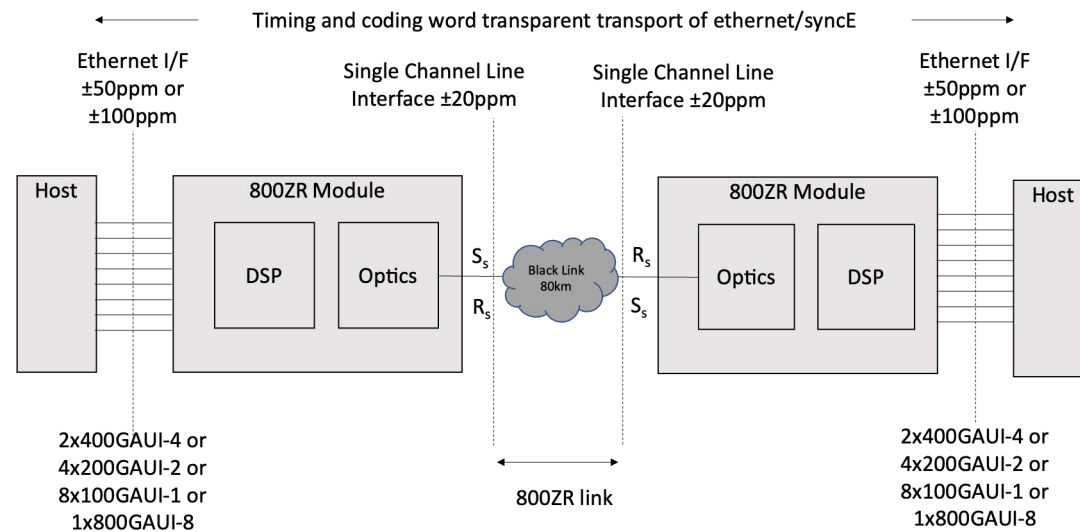
What is 400ZR?

- 400ZR is an interoperable, cost-effective, 400Gb/s interface based on single-carrier coherent DP-16QAM modulation, low power DSP supporting absolute (Non-Differential) phase encoding/decoding, and a Concatenated FEC (C-FEC) with a post-FEC error floor $<1.0E-15$. >80 km. Form-factor agnostic.



What is 800ZR?

- 800ZR is an interoperable, cost-effective, 800Gb/s interface based on single-carrier coherent DP-16QAM modulation, low power DSP supporting non-differential phase encoding/decoding, and OFEC with a post-FEC error floor $<1.0E-15$. $>80\text{km}$. Form-factor agnostic.

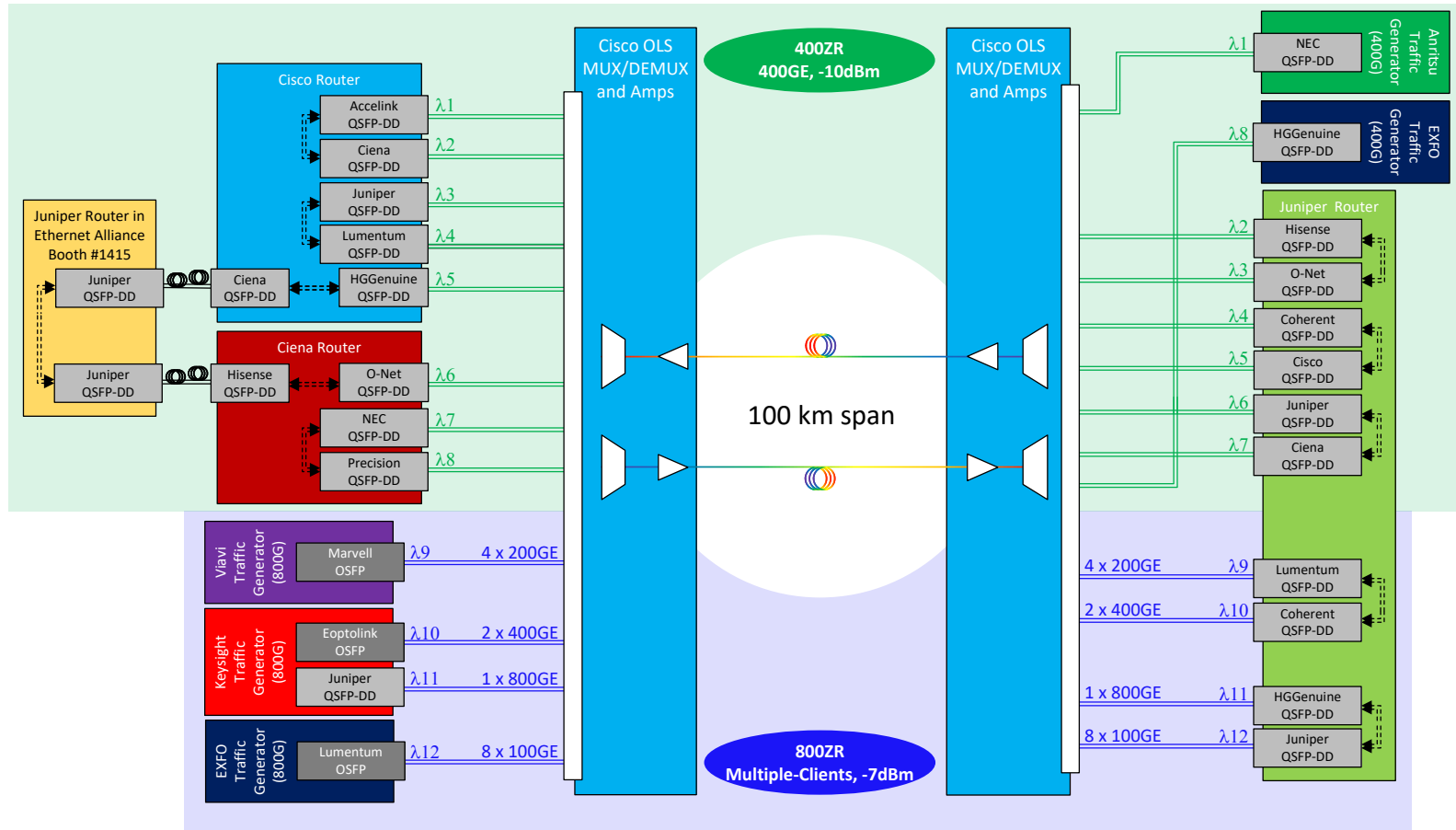


What is 400ZR+?

- 400ZR+ is a generic term for “more capable than 400ZR” and is not standardized across the ecosystem.
- OpenZR+ MSA is the product of an MSA designed to address extended reaches, including flexible Ethernet rates and modulation types. High Tx output power (0 dBm) added in v3.0 (9/2023).
- OpenROADM is the product of the Open ROADM MSA and supports both Ethernet and OTN traffic. Since it is similar, we’ve included it in our demo.



OFC 2024 Single-Span Interoperability Demo

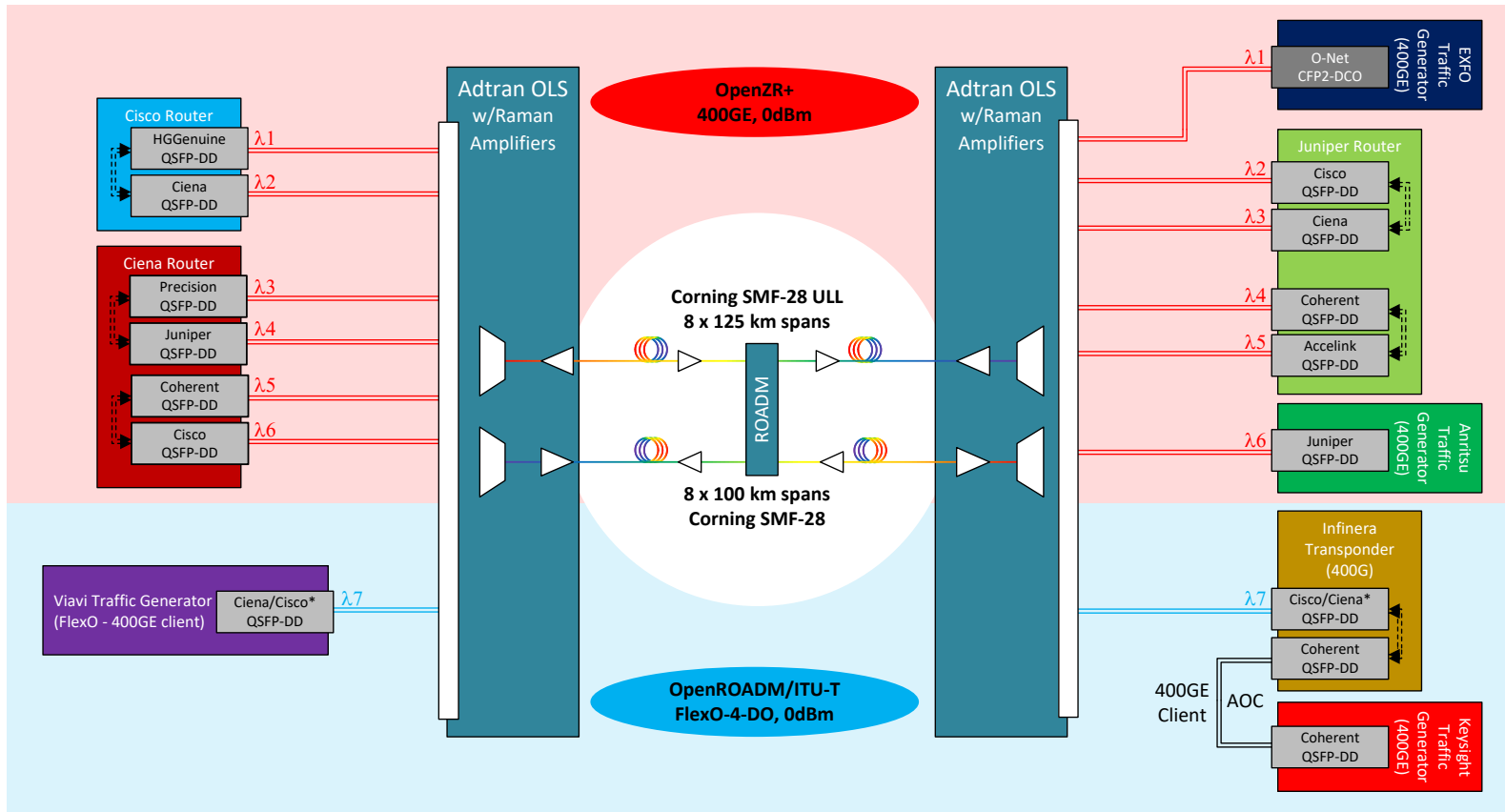


Single-Span Channel Plan

	freq. (THz)	Left-side Port	Module (all QSFP-DD)		Module (all QSFP-DD)	Right-side Port	
400ZR							
{	194.45	Router	Accelink	<	OLS 1	NEC	Traffic
	194.30	Router	Ciena	>	OLS 1	Hisense	Router
{	194.15	Router	Juniper	<	OLS 1	O-Net	Router
	194.00	Router	Lumentum	>	OLS 1	Coherent	Router
{	193.85	Router	HGGenuine	<	OLS 1	Cisco	Router
	to EA	Router	Ciena				
{	from EA	Router	Hisense				
{	193.70	Router	O-Net	>	OLS 1	Juniper	Router
	193.55	Router	NEC	<	OLS 1	Ciena	Router
{	193.40	Router	Precision	>	OLS 1	HGGenuine	Traffic
800ZR							
4 x 200	192.80	Traffic	Marvell OSFP	>	OLS 1	Lumentum QSFP-DD	Router
2 x 400	192.65	Traffic	Eoptolink OSFP	<	OLS 1	Coherent QSFP-DD	Router
1 x 800	192.50	Traffic	Lumentum QSFP-DD	>	OLS 1	HGGenuine QSFP-DD	Router
8 x 100	192.35	Traffic	Lumentum OSFP	<	OLS 1	Juniper QSFP-DD	Router



OFC 2024 Multi-Span Interoperability Demo



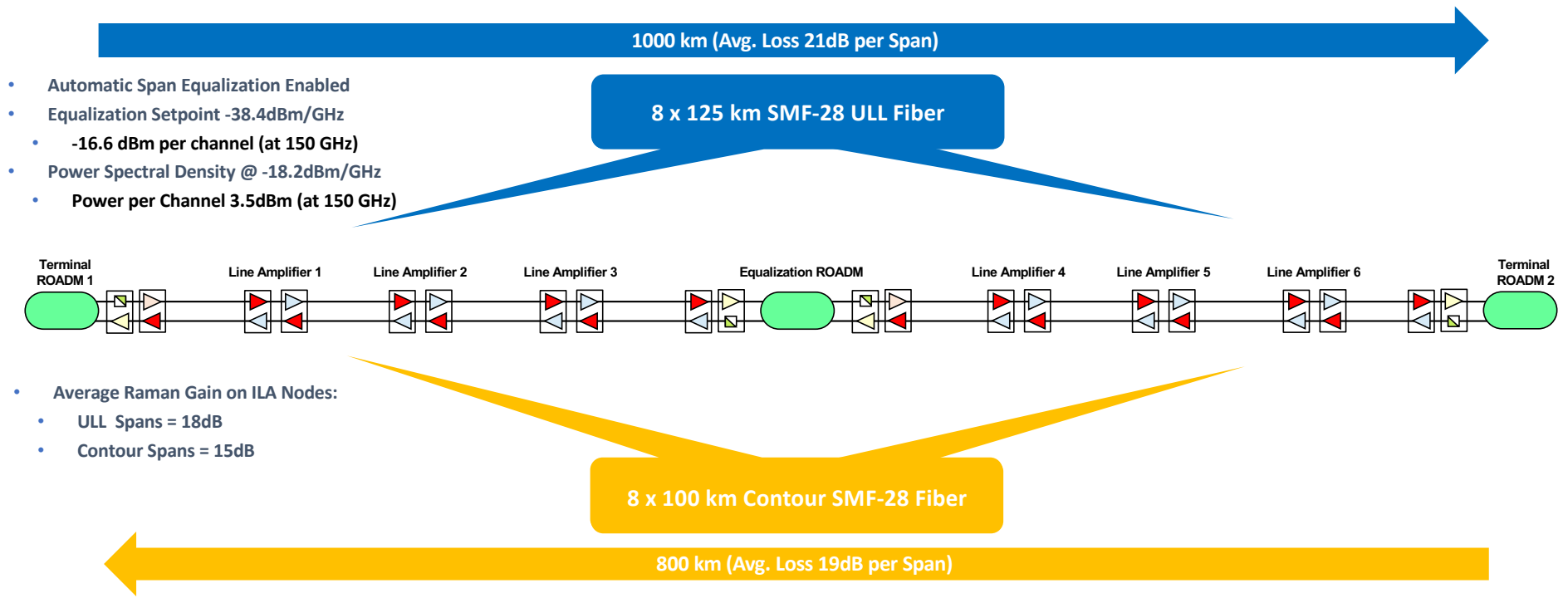
Multi-Span Channel Plan

	freq. (THz)	Left-side Port	Module (all QSFP-DD)		Module (almost all QSFP-DD)	Right-side Port	
OpenZR+ (0 dBm)							
{	192.80	Router	HGGenuine	<	OLS 2	O-Net (CFP2-DCO)	Traffic
	192.65	Router	Ciena	>	OLS 2	Cisco	Router
{	192.50	Router	Precision	<	OLS 2	Ciena	Router
	192.35	Router	Juniper	>	OLS 2	Coherent	Router
{	192.20	Router	Coherent	<	OLS 2	Accelink	Router
	192.05	Router	Cisco	>	OLS 2	Juniper	Traffic
OpenROADM (FlexO-4-DO)							
	191.90	Traffic	Ciena/Cisco*	>	OLS 2	Cisco/Ciena*	Infinera Line
		Traffic	Coherent		AOC	Coherent	Infinera Client
* swap module placement on alternate days							



High Power, Multi-Span Optical Line System

- Compact amplification modules integrating EDFA and Raman amplification
- OSC, monitor ports and Auto-span equalization
- Multi-degree ROADMs for power equalization and scalability.



Optical Fiber Performance

OpenZR+ (0 dBm)	Corning Contour SMF-28 (8 x 100 km)						Corning SMF-28 ULL (8 x 125 km)					
	Module Reported Performance						Module Reported Performance					
	RxOSNR	RxPower	CD	PDL	DGD	pre-BER	RxOSNR	RxPower	CD	PDL	DGD	pre-BER
Vendor A	24.8	-2.93	14000	2.3	1	3.40E-03	23.8	-3.5	16657	4.5	0.84	3.90E-03
Vendor B	25.2	-3.47	13982	2.1	0.59	1.70E-03	22.1	-2.39	16750	5.3	1	9.70E-03
Vendor C	25	-1.62	14156	2	2	3.50E-03	25.6	-3.13	16906	0.9	1	3.00E-03
Vendor D	25.9	-2.34	14260	1.7	1.68	5.19E-03	24.9	-4.95	16984	1.8	1.75	7.13E-03
Vendor E	25.9	-4.76	14340	2.1	2	5.82E-03	24.2	-4.98	17062	3.7	2	1.09E-02
Vendor F	24.1	-3.54	14231	3.1	3	7.47E-03	23.5	-4.13	16940	3.8	2	9.49E-03
Vendor G	24.9	-1.4	13986	2.8	2.1	4.86E-03	24.6	-2.92	16661	1.9	1.7	5.54E-03
Vendor H	24.2	-3.71	14041	1.5	0.9	3.09E-03	23.8	-4.34	16723	2.7	1.8	3.76E-03
Vendor I	24.9	-1.32	14265	2.6	2.6	7.46E-03	24.9	-2.23	17000	2	2	7.12E-03
Vendor J	24.2	-12.9	14343	2.2	3.4	7.36E-03	23.5	-14.24	17093	1.7	2.7	8.23E-03
Vendor K	27	-1.02	14437	2.1	27.7	3.08E-03	27.3	-2.98	17187	3.1	15.4	3.69E-03



OIF Interop Demos

- OFC 2022 – 8 module vendors
 - 14 modules in demo
- ECOC 2022 – 8 module vendors
 - 22 modules in demo
 - White Paper: OIF 400ZR Interoperability ECOC 2022 Plugfest (November 2022)
- OFC 2023 – 13 module vendors
 - 28 modules in demo
 - White Paper: OIF 400ZR Interoperability OFC 2023 Plugfest (February 2023)
- ECOC 2023 – 12 module vendors
 - 400ZR, OpenZR+ (-10 dBm and 0 dBm), OpenROADM
 - 34 modules in demo
 - White Paper: ECOC 2023 OpenZR+ Interoperability Plugfest (November 2023)
- OFC 2024 – 13 module vendors
 - 400ZR, OpenZR+ (0 dBm), 800ZR, OpenROADM
 - 34 modules in demo
 - White Paper: OFC 2024 Coherent Pluggable Ecosystem Interoperability White Paper (April 2024)
 - One page TL/DR version available now!





Special thanks to Juniper for hosting the Plugfest and Dry Run of the OFC demo.

