

CENI testbed & OFCnet updates

Marc Lyonnais, Director, External Research

5th Global Research Platform (5GRP) Workshop 2024

What is the External Research Team?

The External Research (ER) team is part of Ciena's Global R&D organization

- A small team with a focus on research collaboration with external partners.

Examples of areas where the ER team is focused includes:

- Identifying and investigating new technologies, novel architectures, and disruptive innovation.
- Working with both customers and partners to define collaborative research projects that are mutually beneficial to all parties.
- Operating a network research testbed - CENI
- Maximizing return on research investment through government grants and programs.
- Participating in global working groups.
- Attending global R&E related conferences
- Providing sales support and technical consulting for the Research & Education market segment.
- Amplifying the concerns of R&E customers within the R&D organization.

What is CENI?

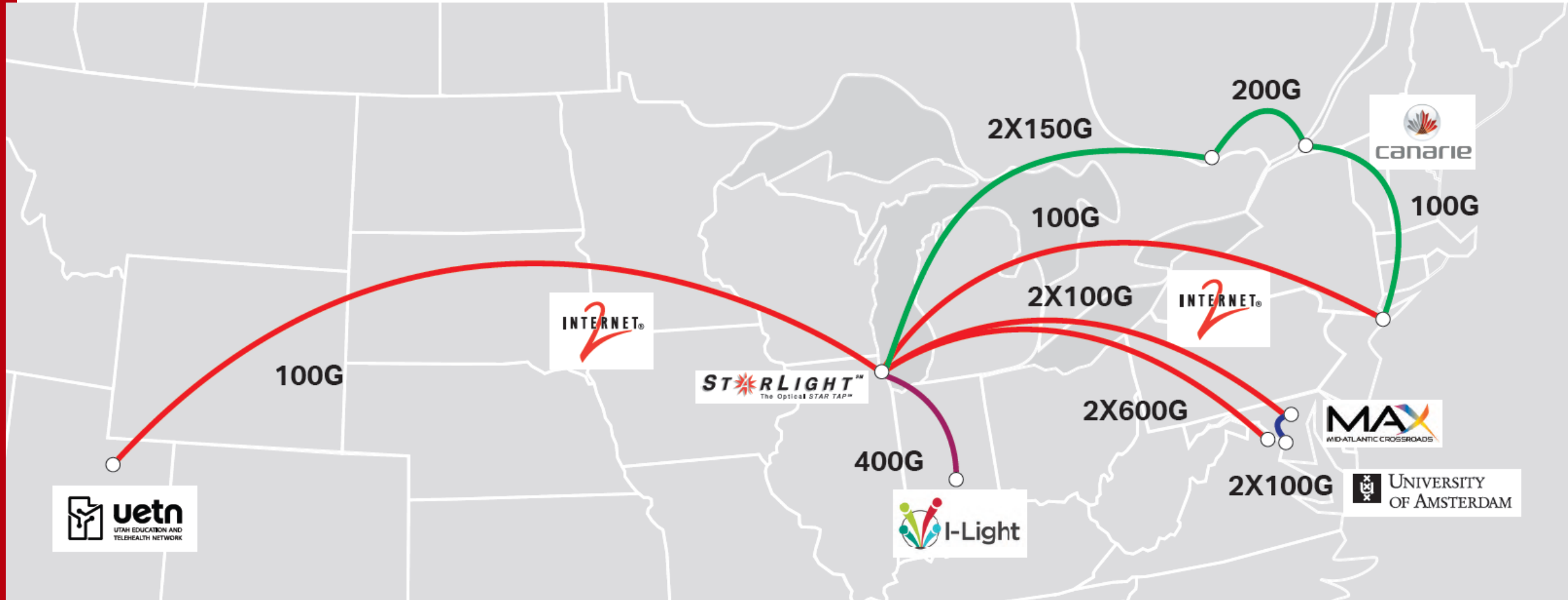
Ciena Environment for Network Innovation

- Built in collaboration with Internet2, Starlight, CANARIE, ESnet, UvA, MAX, UETN.
- Combination of compute resources, switching, and transport equipment as a distributed, shareable resource to foster research, innovation, and collaboration.
- Initially tightly coupled to the GENI/ExoGENI programs (hence the name)
- Sufficiently isolated from the Ciena internal R&D network to allow for external users without putting Ciena IP at risk.

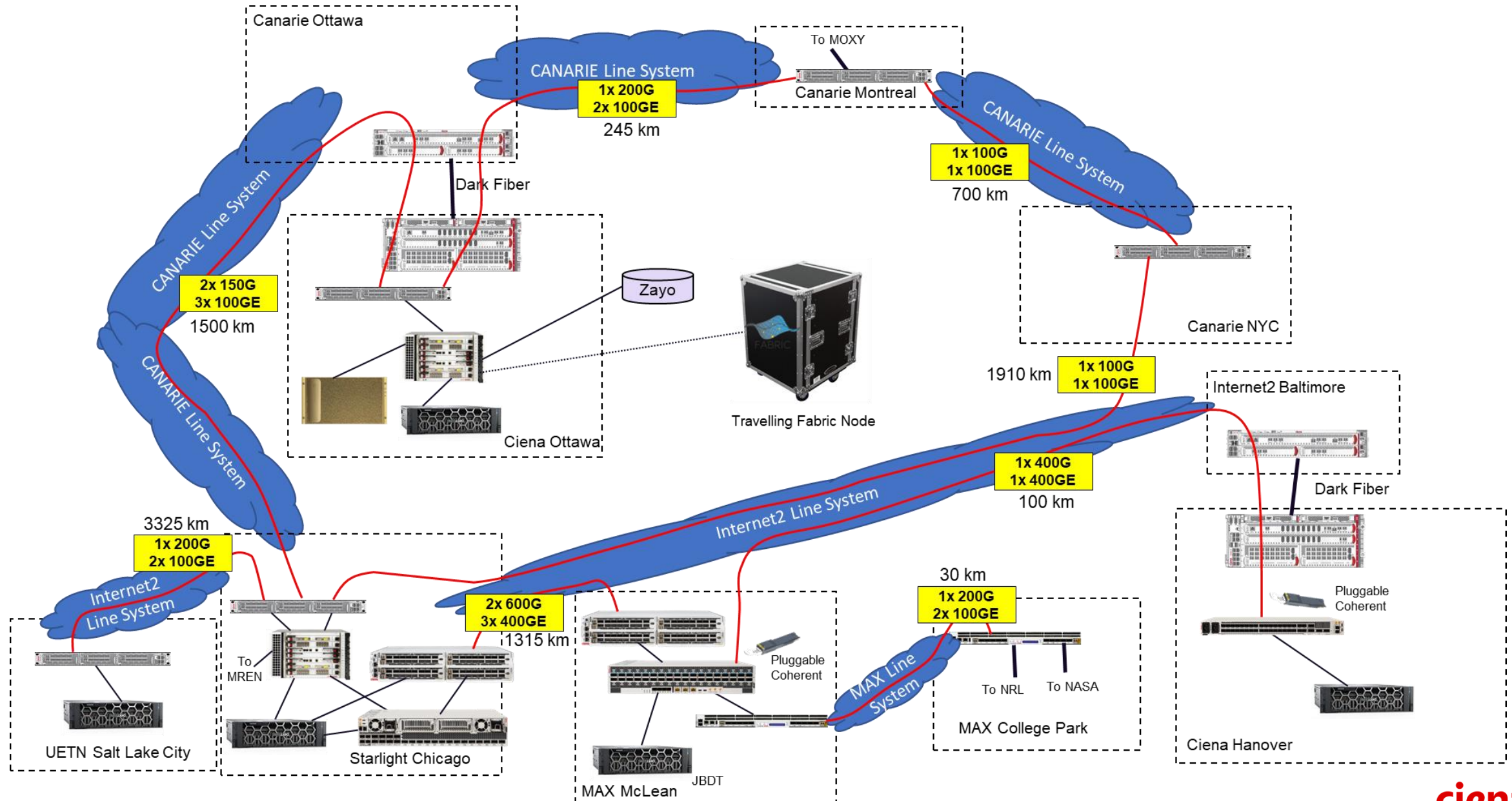
Typical Use Cases

- Facilitate collaborative network research projects with external partners.
- Testbed for novel applications and architectures.
- Evaluation of new Ciena products and features in an R&E environment.

Ciena's research-on-demand network topology 2023



Current CENI Topology



Current CENI Compute Resources

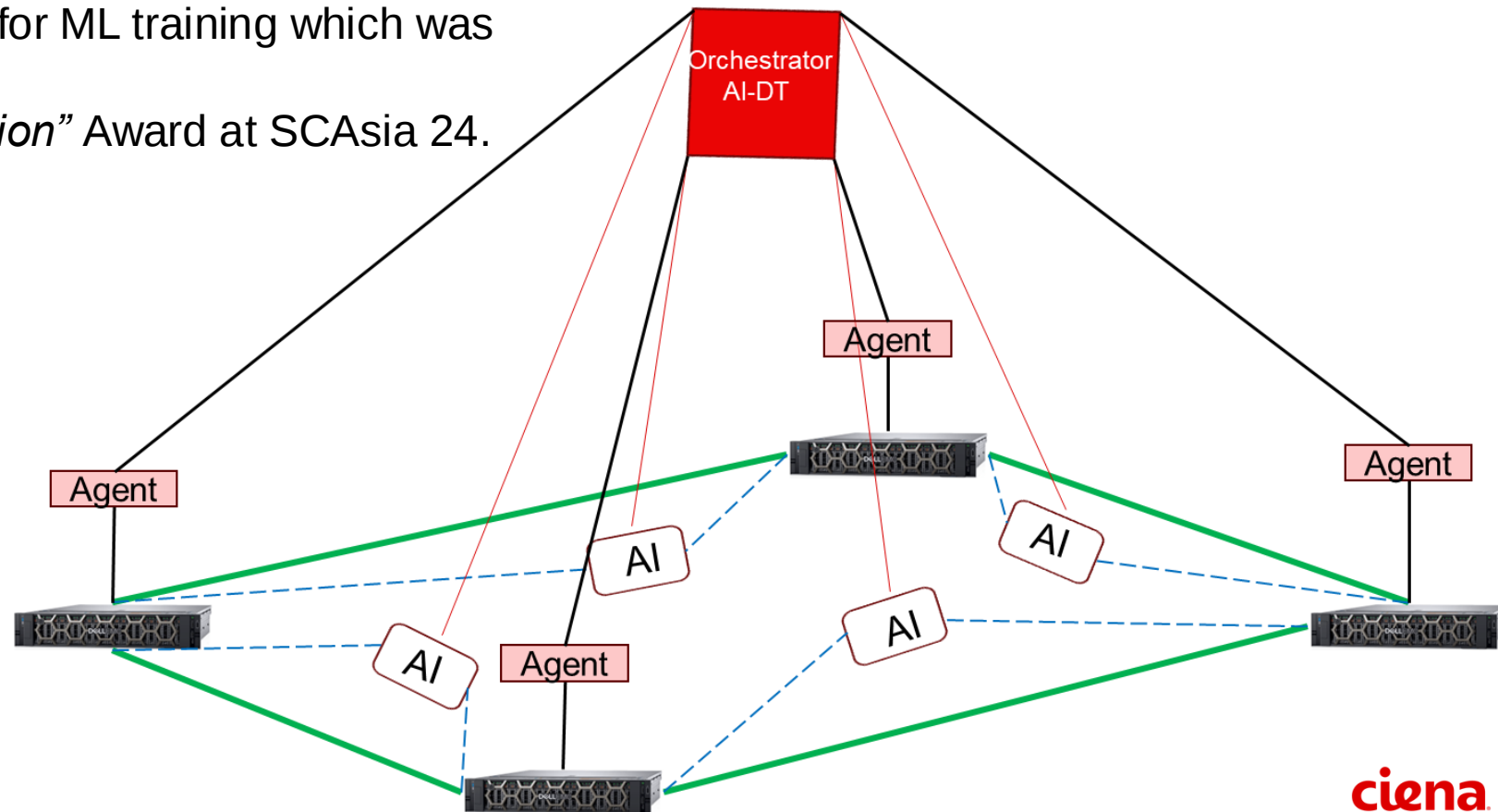
Combined resources across all sites:

- 38 servers
- Programmable NICs
- 900 CPU cores
- 10 GPU
- 8 TB memory
- 435 TB storage

Access to additional shared resources at other partner sites.

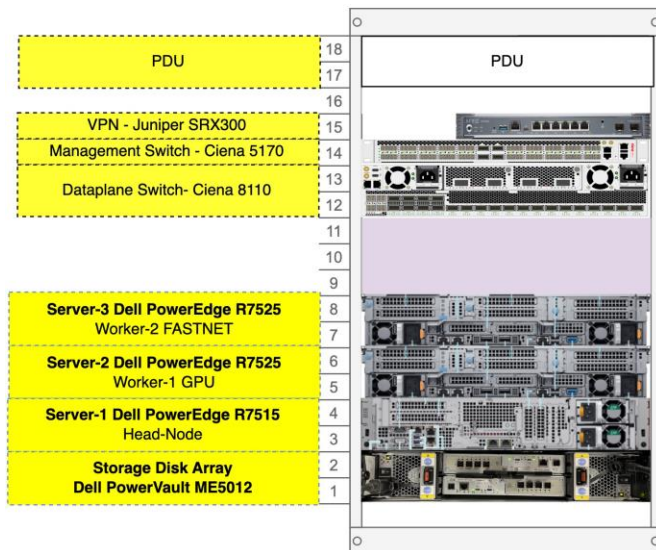
Data Mover Challenge at SCAsia24

- Collaboration with Ciena, ESnet, iCAIR, UETN, uOsaka
- Several approaches to bottleneck mitigating and I/O smoothening for 'mismatched' DTNs
- Predictive Analytics and ML/estimation strategies to optimize transfer parameters.
- CENI used to construct dataset for ML training which was used at DMC23
- Awarded *"Most Innovative Solution"* Award at SCAsia 24.

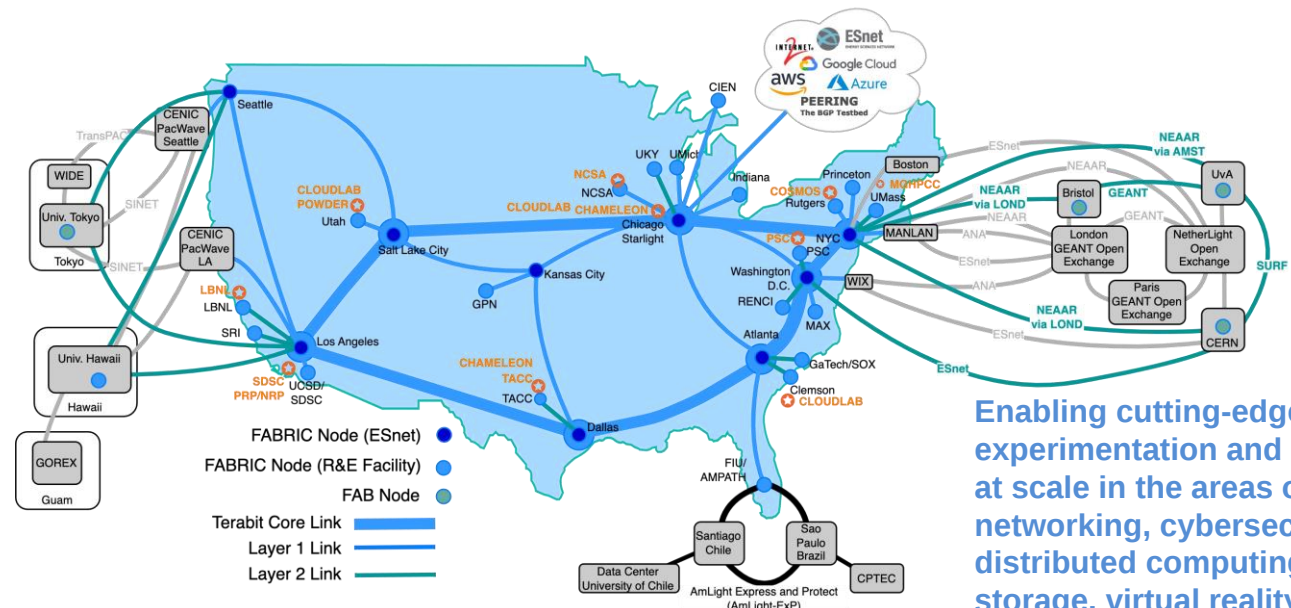


Ciena Traveling FABRIC Node

- A Ciena version of a mini-FABRIC node, called *tfNode* or *traveling Fabric Node*.
- Node uses Ciena RSP based 8110 platform switch as dataplane switch with support for 10/25/100/200/400 GE clients as well as DWDM plugs.
- Designed with 2xRTX6000, SN1000 FPGA, Conect X-6 Mellanox NICs
- Was part of OFCnet 2024, and planning to be part of SCinet for SC24.



Mobile FABRIC Site - Travels to conferences and events



FABRIC is a National Science Foundation (NSF) funded Terabit core international infrastructure

Enabling cutting-edge experimentation and research at scale in the areas of networking, cybersecurity, distributed computing, storage, virtual reality, 5G, machine learning/artificial intelligence, and science applications.

Future Topology Evolution Plans

Increased capacity, resiliency and footprint

- 400GE based-backbone
- Extension to Europe and US west coast.
- Collaboration with existing testbeds like NA-REX and Fabric to reach new locations.

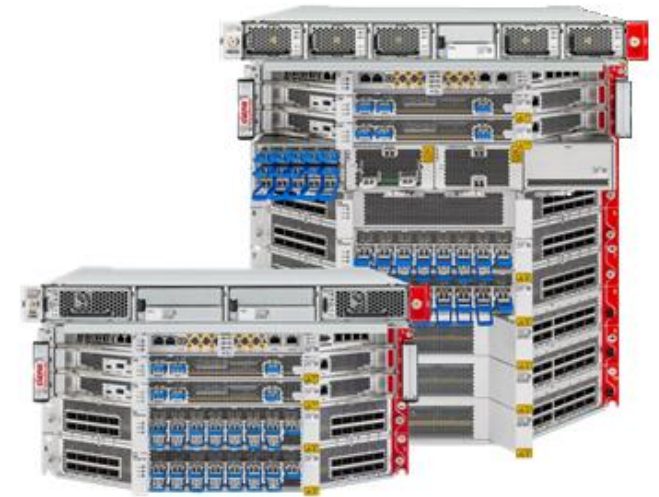
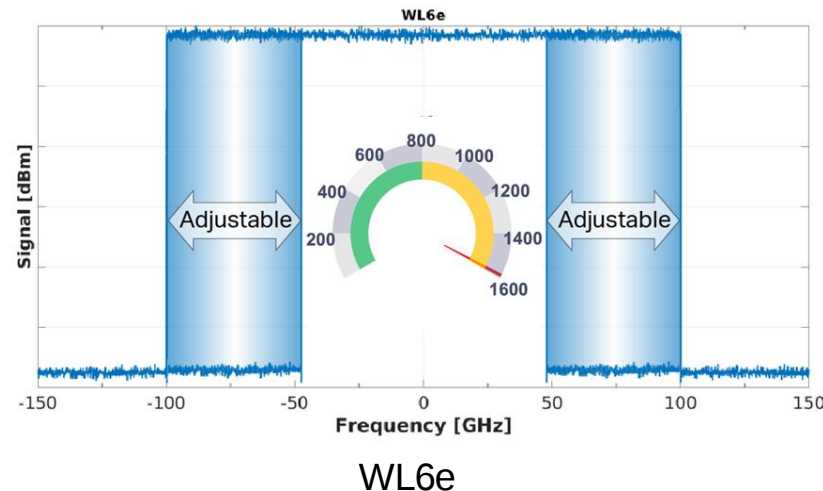
Continued focus on migration to GPU resources and exploring applications of AI/ML coupled with streaming telemetry from the network.

Integration of new converged L0-L3+ platforms, e.g. Waverouter.

Integration of WL6e/WL6n and 800GE



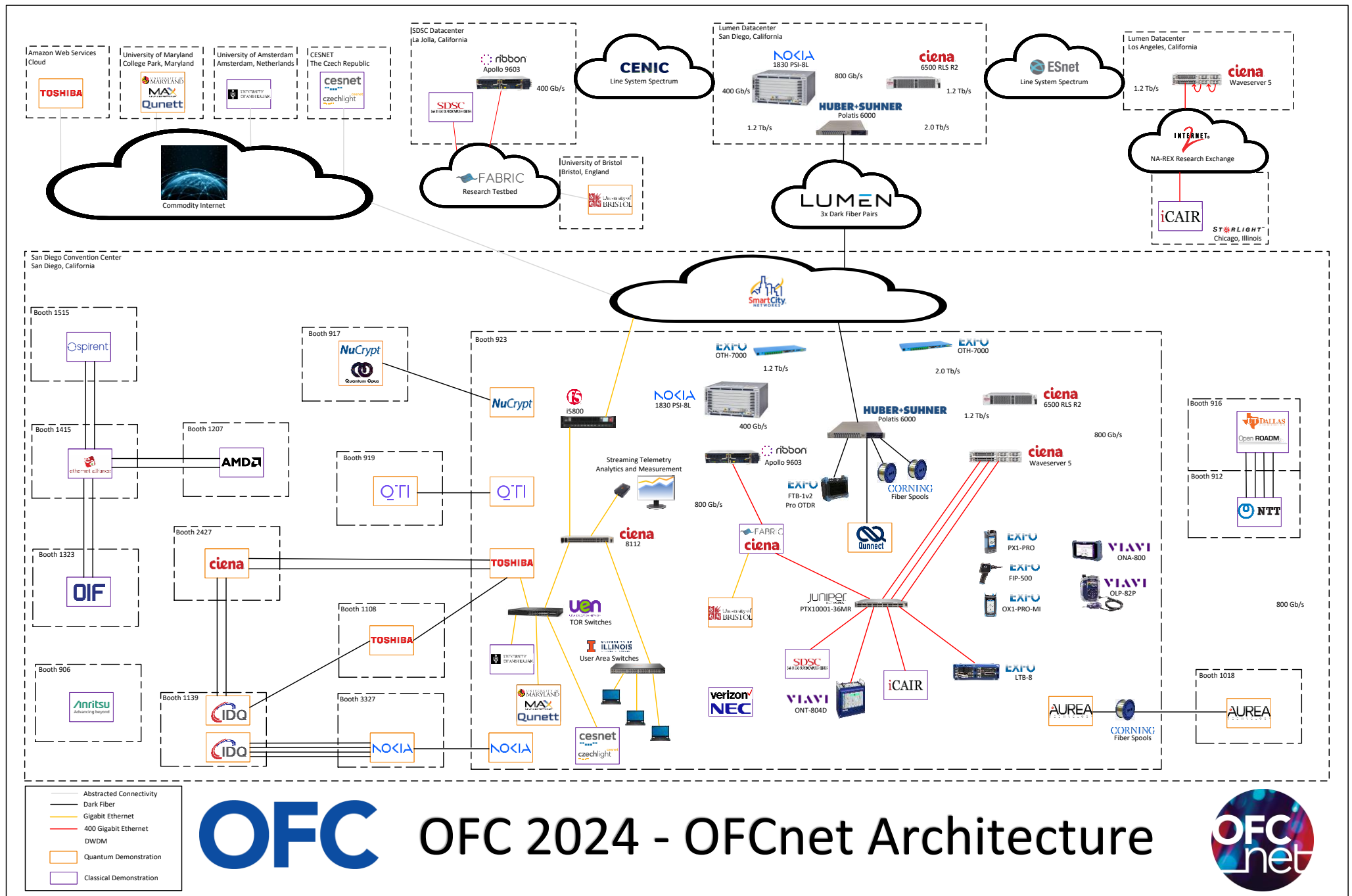
8192 (J3, QSFP112 based)



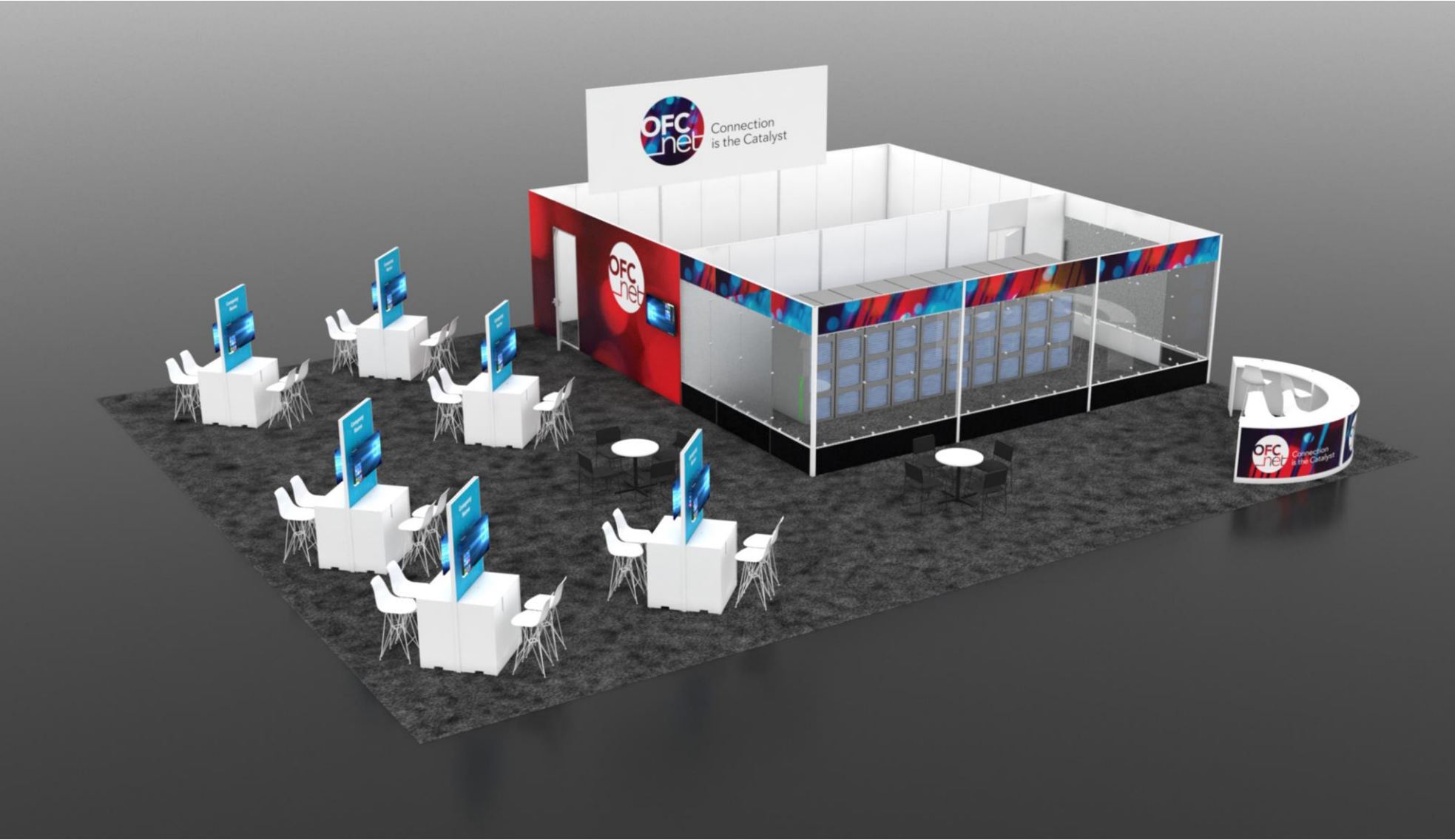
Compact WaveRouter Offerings



OFCnet Update



Booth Layout



The demonstrations

20 demonstrations, 9 about Quantum Networking from:

- AUREA Networking
- Ciena, ID Quantique and Toshiba (counts for 2)
- NuCrypt, Argonne National Labs, Fermi National Accelerator Lab, NWU and Quantum Opus
- Nokia and ID Quantique
- Qunnect
- University of Bristol
- QTI, Telsy, Tim and SM-Optics
- Qunett and University of Maryland

Demonstration abstract can be found at: <https://www.ofcconference.org/en-us/home/exhibition-and-show-floor-programs/ofcnet/ofcnet-demonstrations/>

The Classical Network demonstrations

- Anritsu
- CESNET
- Ciena/FABRIC/SDSC
- ICAIR/Northwestern University
- NEC/Verizon/OFS
- NTT/IOWN Networking Hub (2)
- Open ROADM MSA/IOWN
- University of Amsterdam (2)
- University of Bristol

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400G Data Center Services Over WAN Prototype

-The prototype service transits 5 different WAN testbed providers:

- Internet2
- NA-REX
- ESnet
- FABRIC
- CENI & Partners

-The DTNs in StarLight for this prototype are highly customized R760s, each with CX7 single 400G port with OSFP interfaces.

-The same 2 systems are used for all tests.

-Tuning applied depends on the distance/latency.

Extend Data Center Services Over 400G WAN

Prototype Solution Initial Results:

Single stream RDMA/RoCE over 400G network at different distance

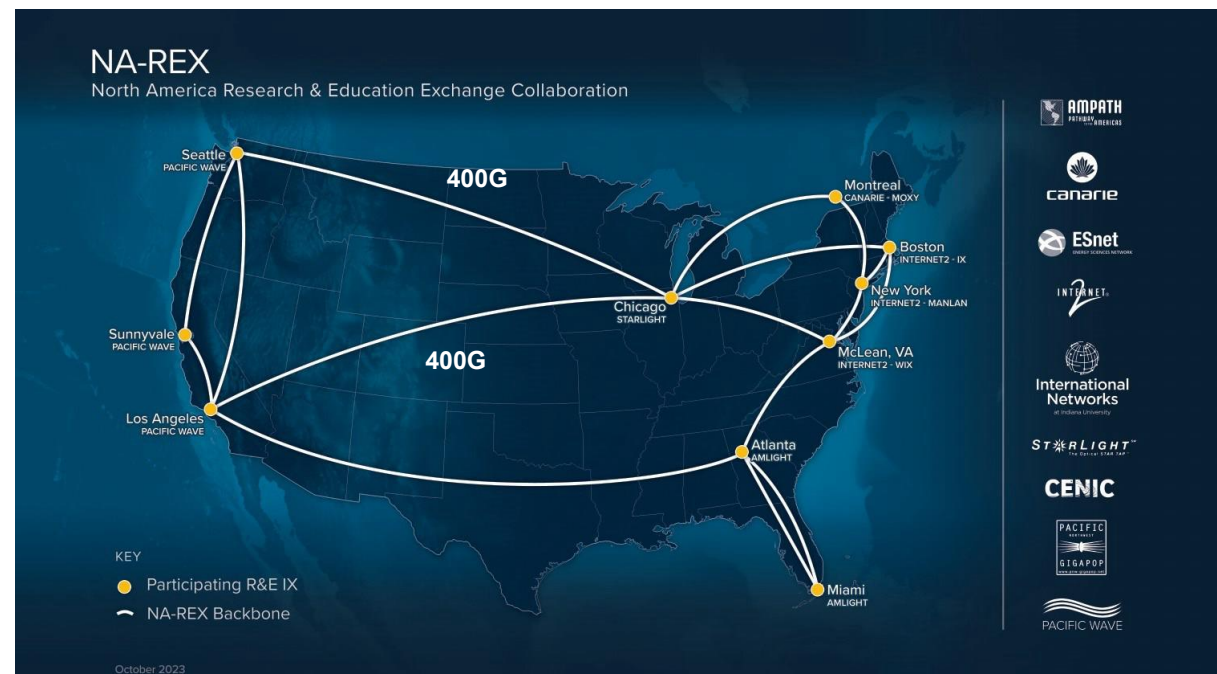
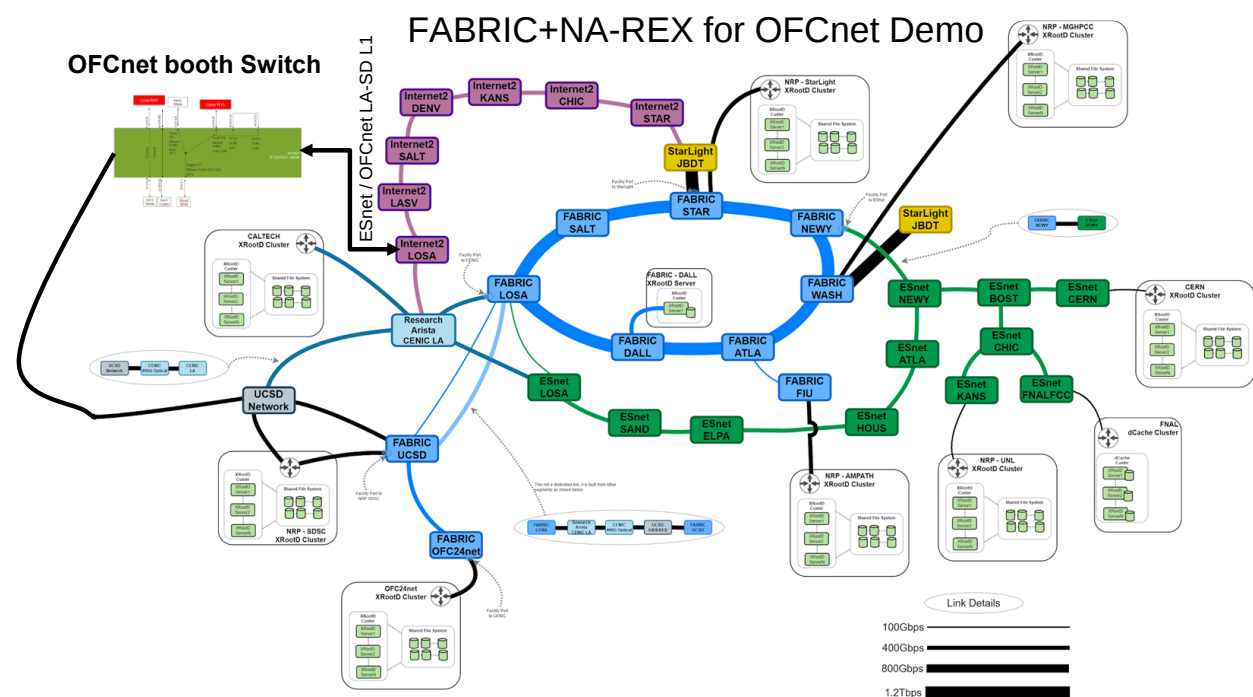
(1) CENI Chicago - McLean VA	(2) NA-REX Chicago -L.A /San Diego	(3) FABRIC + NA-REX Chicago-L.A	(1) CENI Chicago - McLean VA	(2) NA-REX Chicago -L.A /San Diego	(3) FABRIC + NA-REX Chicago-L.A
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SL loopbacks: (1) Rtt 27 ms @ **395G** (2) Rtt87 ms @ **388G** (3) Rtt 108 ms @ **397G**

iCAIR

STARLIGHTSM SDX





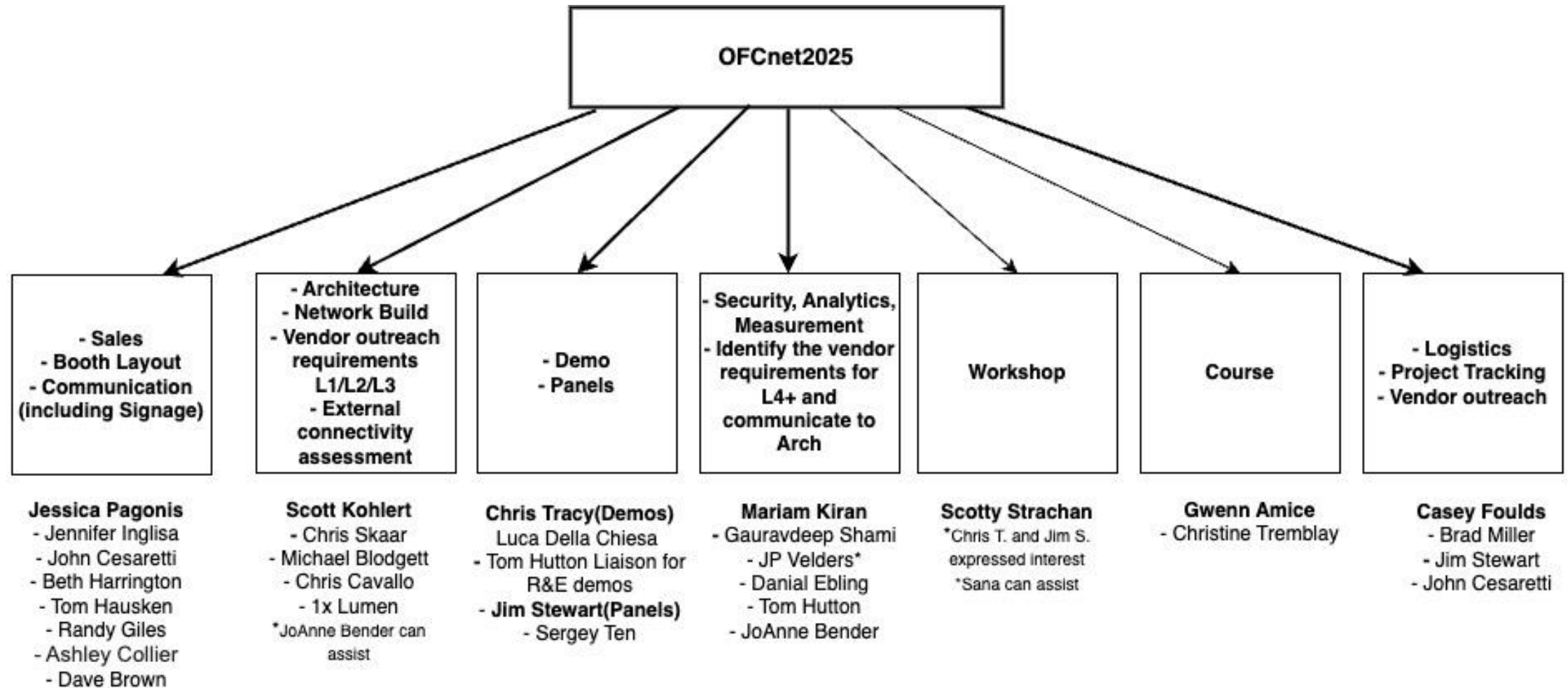




OFCnet2024 and 2025

Sana Bellamine is the OFCnet chair for 2025-2026
editions

OFCnet 2025 Roster



OFCnet2025 Workshop:

Networks of the Future & Next-Generation Production

Abstract:

OFCnet2025's vision is for OFCnet to be a bridge between the OFC technical conference and “networks of the future”. The OFCnet2025 workshop will be a forum that enhances development of next-generation networks by highlighting cutting-edge technologies and applications introduced during the OFC conference that are gaining maturity and will impact near-term production design as well as the networks of the future. The workshop will focus on these four key areas:

- Automation and Orchestration: how does a networking team evolve with this?
- Trend analysis and failure prediction: standardized data collection for Machine Learning
- Quantum networking early wins: report-out on the state of implementation
- Networks of the future: bleeding-edge technologies and how soon will they be here?

For more information on OFCNet program see : <https://www.ofcconference.org/en-us/home/exhibition-and-show-floor-programs/ofcnet/>



Questions?

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Thank You