Global Research, SCinet, NRE Program, CENI & OFCnet

GRP Meeting at SCA25 | Singapore

March 13, 2025

Rod Wilson - rwilson@ciena.com

FLY OVER

- Global Research Platform & Ciena
- SCinet (Atlanta, US)
- NRE Program at SC24
- CENI (Ciena Environment for Network Innovation)
- CENI Planned Upgrades in 2025
- CENI Support SC24 and OFCnet

ciena

Global Research Platform & Ciena

Deeply Committed Network Research Partners

- Rich and 25+ year history of partnership and collaboration with the Global Research Community
- Ciena External Research Team seeks and aspires for collaboration with the brightest minds and sharpest thinkers engaged in “curiosity” based academic research in advanced cyberinfrastructure for Data Intensive Science.
- Keystone NRP partners span the Globe, some are deep project collaborators, some are research path enablers, some knowledge engines

Testbed = Experimental Network

- Open Testbeds drive innovation and serve as proving grounds for advanced cyberinfrastructure
- Ciena’s investment in testbeds is fostering innovation and generating real value for the ecosystem
- National Data Platform (NDP at UCSD) is enabling Data Ecosystem for Innovation
- NDP is also designed to foster innovation and collaboration through an open science data federation

What’s in it for Ciena? Why are we here?

- Research Platforms are mind expanding screw-ups for those stuck on traditional networking solutions.
- Understanding future demand directions. You are our customers’ customer.
- Participation is mutually beneficial. You are part of our innovation ecosystem.

Expected Outcomes

- Vibrant R&E cyberinfrastructure (CI) ecosystems that deliver services that change the human condition.
- Inspire the next generation of knowledge professionals, scientist, CI engineers, technicians, and educators
- Innovation, solutions, feedback loops for continuous improvements

ciena

SCinet

SC24 – Atlanta, United States

SC24 SCinet Architecture

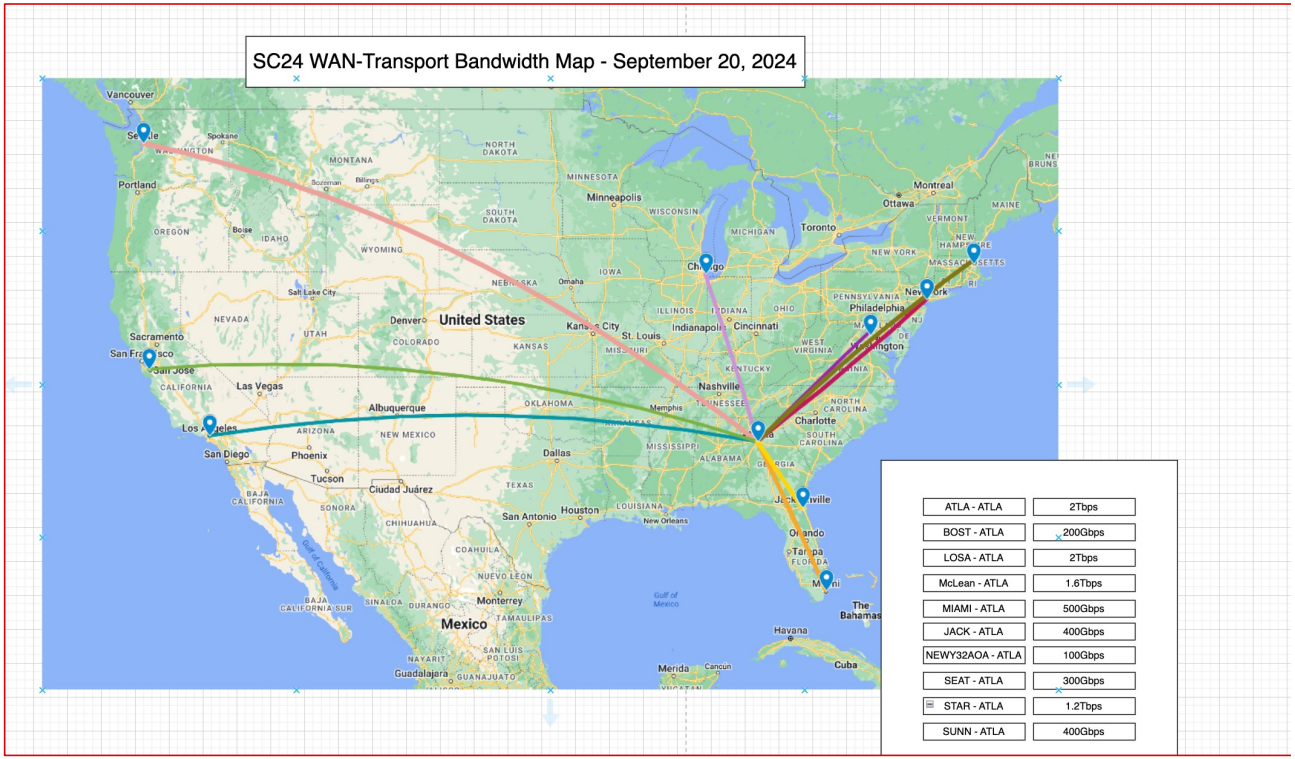
SCinet provided both conference infrastructure, global lightpath network and high-performance demonstration networks

Key features

- 8.71 Tb/s of WAN bandwidth
- Science DMZ
- Integrated HPC cluster
- Integrated FABRIC node
- Network Research Exhibition

NRE Samples

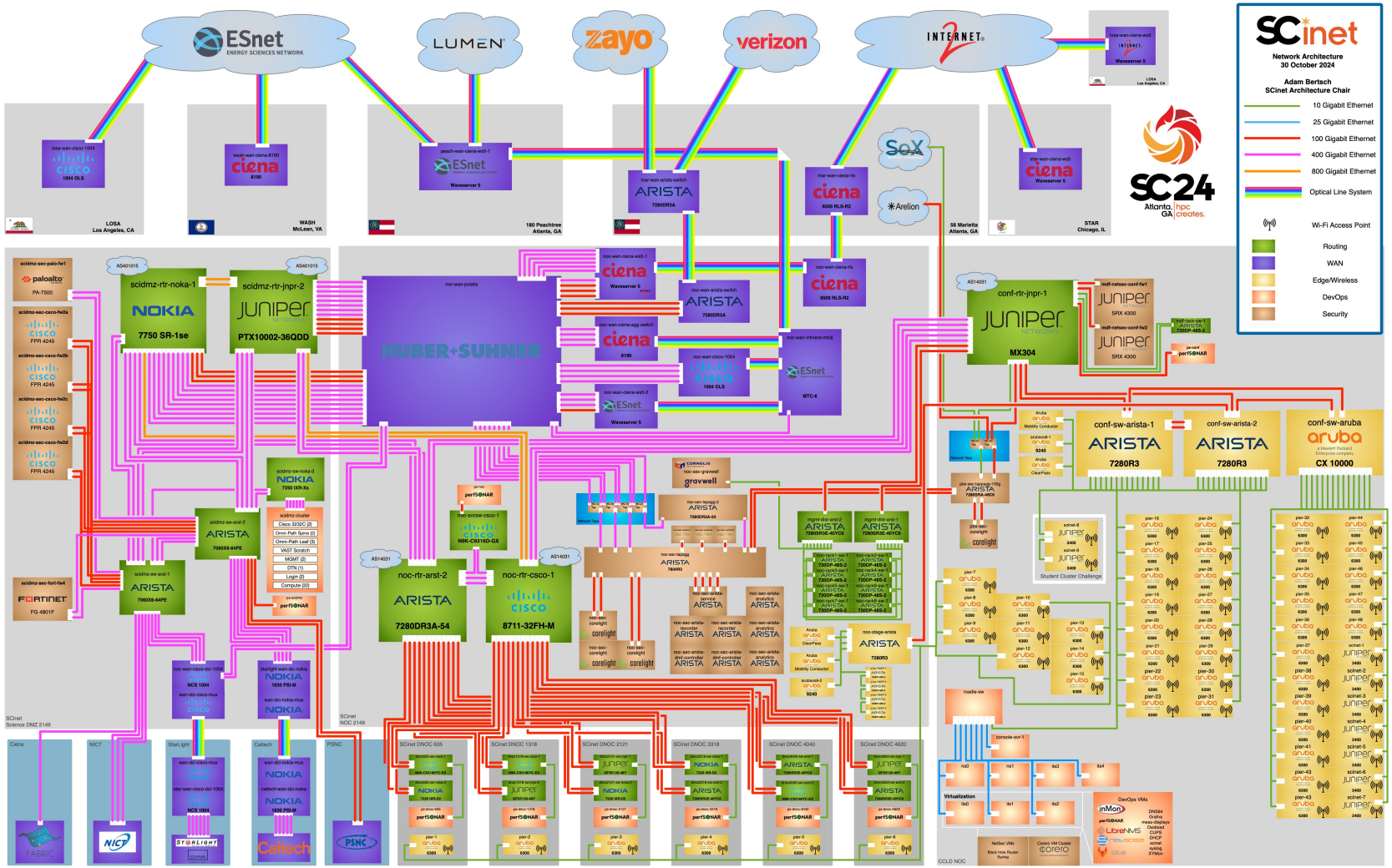
- GRP focuses on design, implementation, and operation strategies for next-generation distributed services and infrastructure
- Gamma-Ray Energy Tracking Array (GRETA) and Distributed Event-Level Experiment Readout and Integrated Analysis (DELERIA)
- Prototype 1.2 Tbps WAN Infrastructure: Architecture, Technology, and Control
- In-Network Remote Trust Attestation for Science DMZ
- ESnet Wireless Edge Automation; On-demand Secure Circuits and Advance Reservation System (OSCARS)



37 NRE live demonstrations

https://sc24.supercomputing.org/scinet/network-research-exhibition/accepted-nre-demos/

SC24 Final Architecture



ciena

Ciena Skin in the Game

People

Ciena funded three volunteers for SCinet in 2024. They played a key role in planning, staging, setup, show, teardown activities & organized a workshop

- Akbar Kara
  - Co-chair – Innovating the Network for Data Intensive Science (INDIS) Workshop with peer reviewed proceedings
- Gauravdeep Shami
  - WAN team member
- Anthony Gloriana
  - WAN team member

Other members of the External Research Team within Ciena provided support and mentoring for our volunteers.

Tech

For over the 20+ years, Ciena provided cutting-edge equipment and expertise to enable the SCinet's cutting-edge infrastructure.

- **2024**
  - 3x 400GE circuits between Chicago Starlight and the Atlanta GWCC using WS5 WL5e modems over Internet2 spectrum.
  - 4x 400GE circuits between McLean, VA and the Atlanta GWCC using 8190 and WL5n coherent pluggable optics over ESnet spectrum (~ 1300 km route).
  - RLS point-point line system to extend the Internet2 photonic backbone into the convention center in Atlanta.
  - Travelling FABRIC node consisting of storage, compute, switching and routing including 5170 and 8110 to extend the FABRIC testbed into the show floor.

Collaboration

Ciena is also loaning equipment to our customers and collaborators to help reach the edges of the SCinet network.

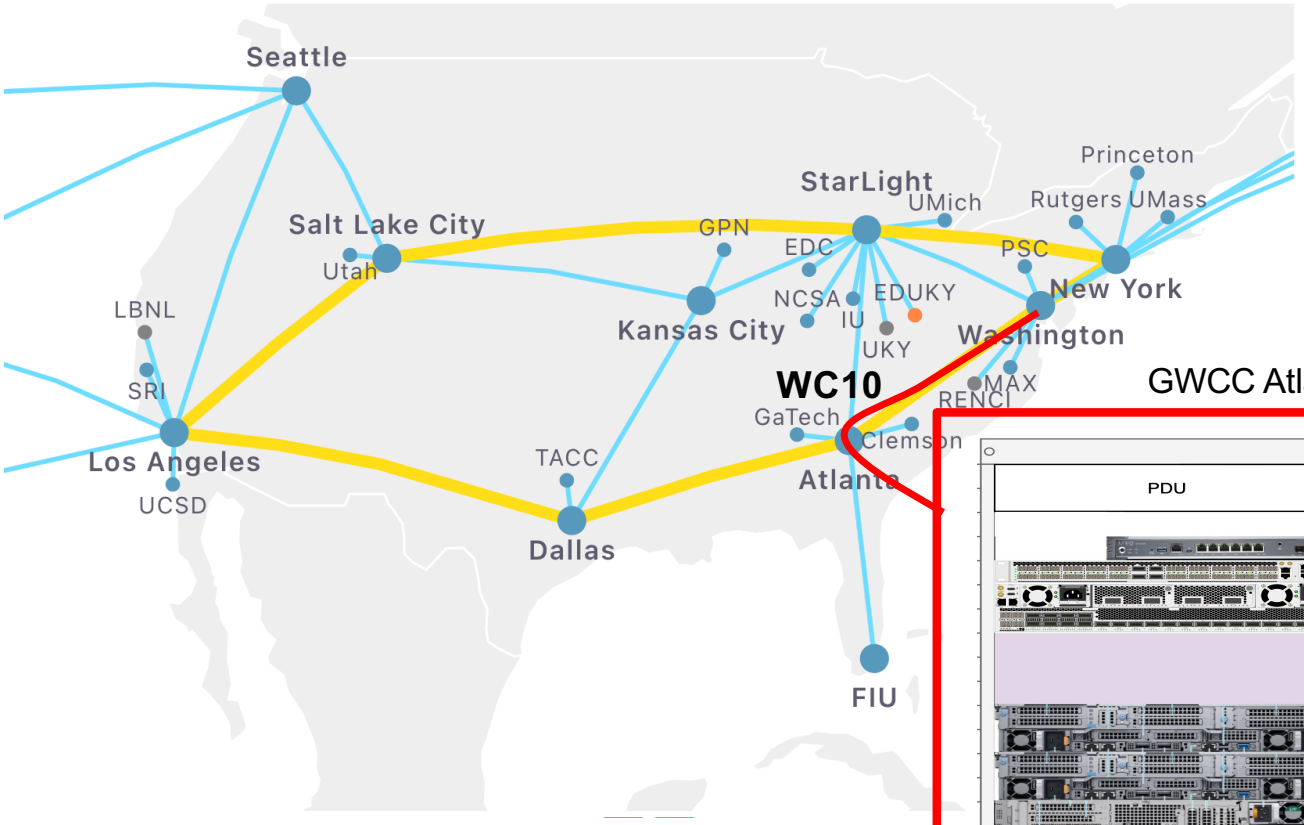
- Caltech / GNA-G
  - 4x 400GE link between Caltech campus and Los Angeles exchange point using WL5e modems and CMD10 on WSAi platform.
- Florida International University / AmLight
  - 8190 chassis to provide 400GE switching capability

Ciena's evergreen CENI Testbed infrastructure is also on the critical path for many research demonstrations beyond the scope of the SCinet network.

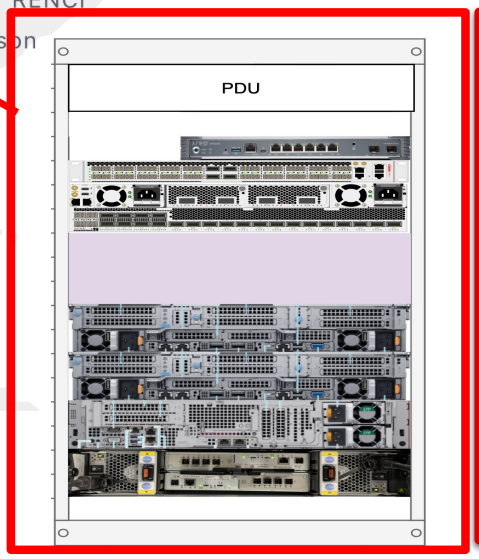
- 3x 400GE link between Chicago and McLean using WS5 and WL5e 600 Gb/s waves.
- Ciena 8190 (packet) in McLean is the core switch for the Joint Big Data Testbed currently providing 6.5 Tb/s of switching capacity.

ciena

Ciena Travelling Fabric Node (tfNode) at SC24



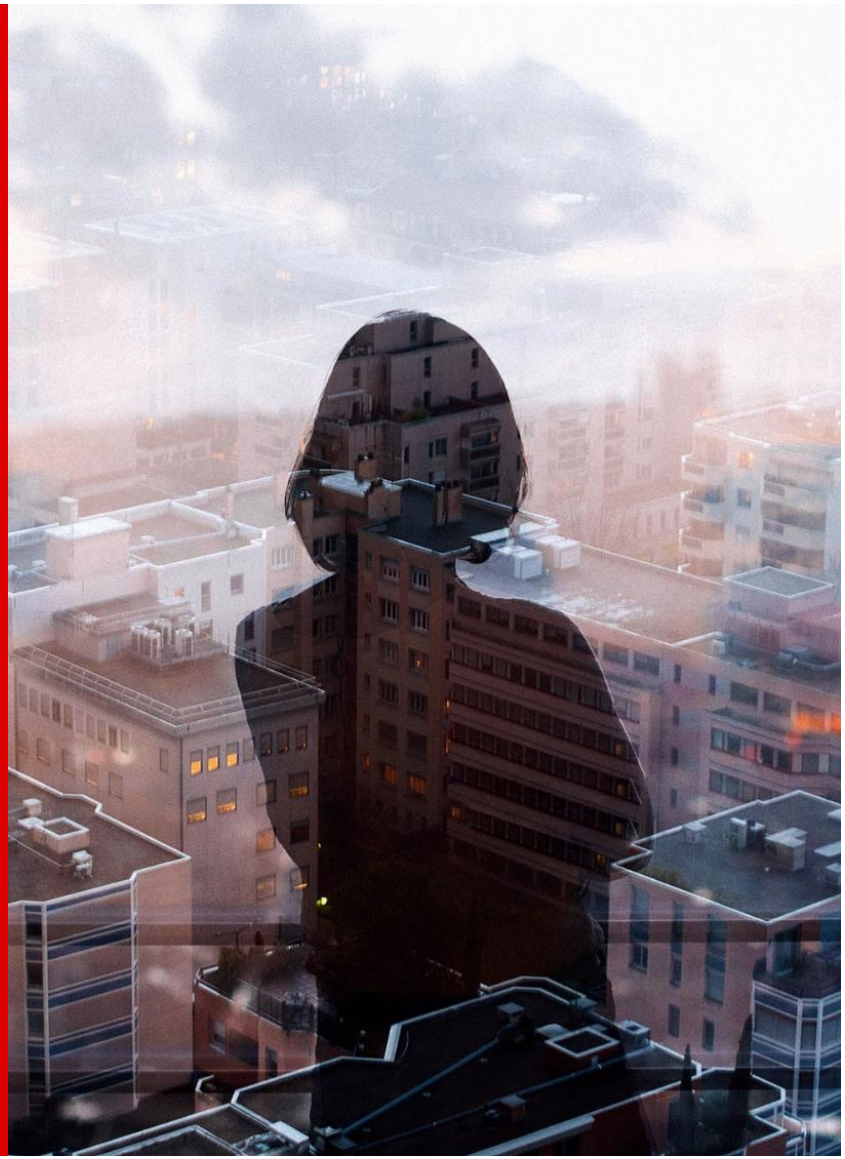
GWCC Atlanta



- Open community resource
- Integration for L2Bridge and L2PTP services complete with Ciena 8110 and Cisco NSO.
- Latest Generation of GPU and FPGA offering
- Node capable of multiple x400Gbps direct WAN connectivity

Ciena's Environment for Network Innovation

Enabling Research Platforms with >1Tbps speeds



CENI Introduction

- A cutting-edge terabit enabled research platform built in collaboration with Ciena and the R&E Community:
- CENI, a successful collaboration among Industry-R&E-Academia.
- CENI is an accelerator for applied network research and facilitator of state-of-the-art demonstrations.

CENI-at-a-Glance

CENI Testbed Spans 8 Geographical Sites in United States and Canada. To Netherlands when needed.

Estimated Fiber km Traversed:

9200+

Total Bandwidth:

2.7 Tb/s of transport capacity. Evergreen, with new product & pre-GA product rotation

Combined compute resources:

38 servers; 900 CPU cores

16 GPU

9 TB memory

500 TB storage

Programmable NICs and switches

ciena

CENI Equipment in Service of our Collaborators and Partners

CENI equipment is also loaned and leveraged to:

Facilitate specific science drivers and meet time-sensitive requirements that collide with normal sourcing timelines.

Example #1 – CANARIE datacenter migration

- Provided WSAi equipment in order to create alternate paths to support CANARIE migration of their downtown Ottawa data center, minimizing service impacts for CANARIE end-users.

Example #2 – NA-REX/Internet2 WS5 equipment loan

- Provided WS5 WL5e transponders for Starlight and Los Angeles to facilitate migration of the NA-REX circuit on to a dedicated wave in time for OFC 2024.
- Instrumental in the success of ICAIR experiments related to single flow 400GE data transfers

Example #3 – GNA-G DIS/Caltech/CENIC WSAi equipment loan

- Provided WSAi WL5e modules for both the Caltech campus and CENIC space in Los Angeles.
- 1.6 Tb/s link over dark fiber between the Caltech campus and the rest of the GNA-G DIS R&E community.

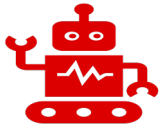
ciena

CENI SC & OFC

Application of persistent product and services for quick, low-cost contribution deployment

1.2 Tb/s between Starlight and McLean & 1.6 Tb/s between Caltech and Los Angeles were heavily utilized for multiple NREs.

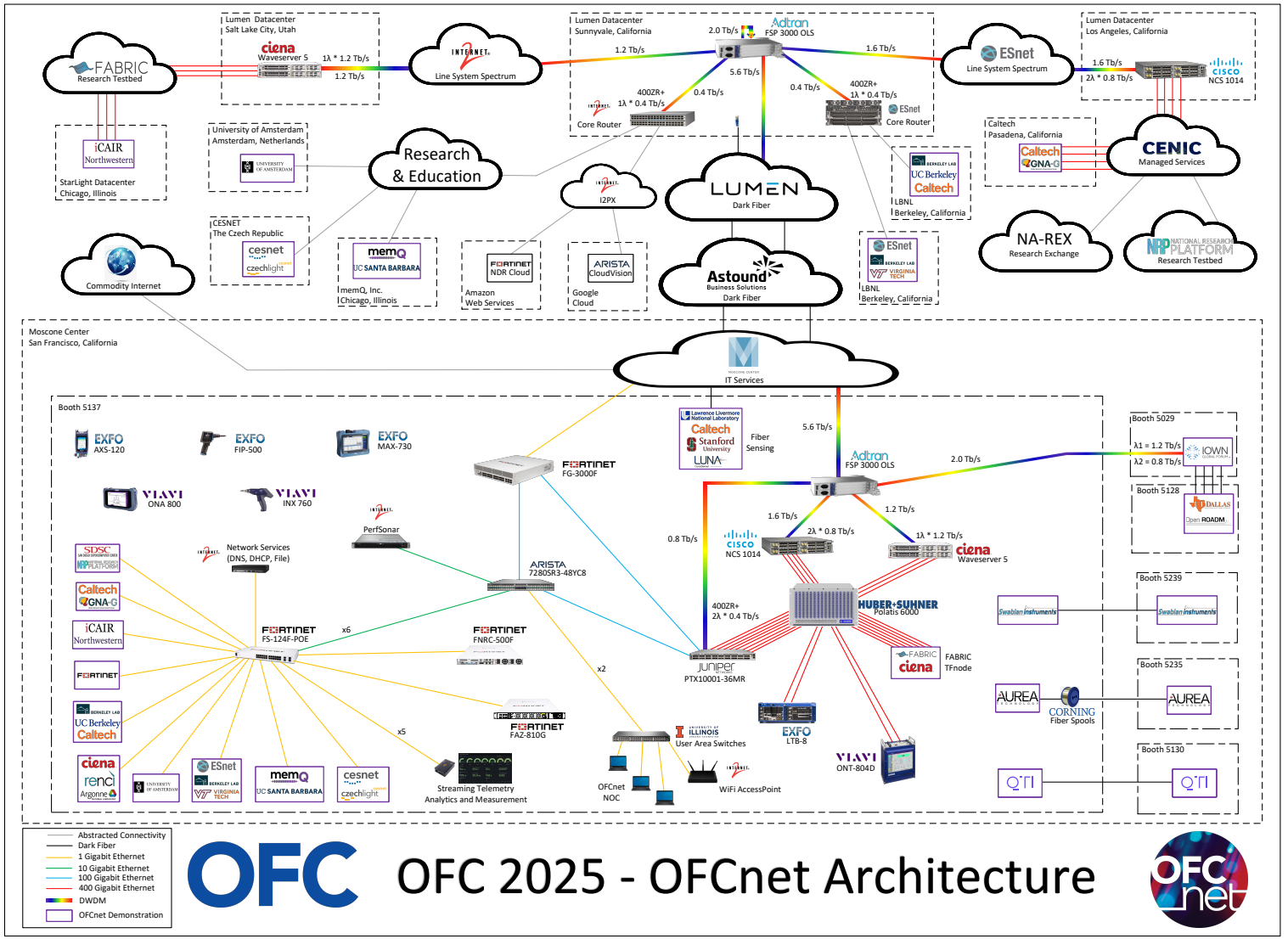
CENI enabled multiple direct 400GE paths among FABRIC tfNode at the Ciena booth and FABRIC McLean Hub using Ciena's WL5n coherent plugs between the SCinet NOC in Atlanta and McLean.



Outside of CENI resources, Ciena also supported SC24 WAN and NRE requirements:

WaveServer5, RLS line system, 8190 Packet Switching, and pluggable coherent optics

ciena


FABRIC
Research Testbed
Lumen Datacenter
Salt Lake City, Utah
ciena
Waveserver 5
1λ * 1.2 Tb/s
1.2 Tb/s
Line System Spectrum
Lumen Datacenter
Sunnyvale, California
2.0 Tb/s
Adtran
FSP 3000 OLS
1.2 Tb/s
1.6 Tb/s
5.6 Tb/s
0.4 Tb/s
400ZR+
1λ * 0.4 Tb/s
Core Router
ESnet
Line System Spectrum
Lumen Datacenter
Los Angeles, California
1.6 Tb/s
2λ * 0.8 Tb/s
CISCO
NCS 1014
iCAIR
Northwestern
StarLight Datacenter
Chicago, Illinois
University of Amsterdam
Amsterdam, Netherlands
Research
& Education
I2PX
LUMEN
Dark Fiber
UC Berkeley
Caltech
LBNL
Berkeley, California
Caltech
Pasadena, California
CENIC
Managed Services
Commodity Internet
CESNET
The Czech Republic
cesnet
czechlight
memQ
UC SANTA BARBARA
memQ, Inc.
Chicago, Illinois
FORTINET
NDR Cloud
Amazon
Web Services
ARISTA
CloudVision
Google
Cloud
Astound
Business Solutions
Dark Fiber
ESnet
VIRGINIA TECH
LBNL
Berkeley, California
NA-REX
Research Exchange
NRP
NATIONAL RESEARCH PLATFORM
Research Testbed
Moscone Center
San Francisco, California
IT Services
Booth 5137
EXFO
AXS-120
EXFO
FIP-500
EXFO
MAX-730
VIAVI
ONA 800
VIAVI
INX 760
PerfSonar
Network Services
(DNS, DHCP, File)
FORTINET
FG-3000F
Lawrence Livermore National Laboratory
Caltech
Stanford University
LUNA
Fiber
Sensing
5.6 Tb/s
Adtran
FSP 3000 OLS
2.0 Tb/s
1.6 Tb/s
1.2 Tb/s
0.8 Tb/s
2λ * 0.8 Tb/s
1λ * 1.2 Tb/s
CISCO
NCS 1014
ciena
Waveserver 5
ARISTA
7280SR3-48YC8
400ZR+
2λ * 0.4 Tb/s
HUBER+SUHNER
Polatis 6000
FORTINET
FS-124F-POE
x6
FORTINET
FNRC-500F
x2
JUNIPER
PTX10001-36MR
FABRIC
TFnode
x5
FORTINET
FAZ-810G
EXFO
LTB-8
VIAVI
ONT-804D
User Area Switches
OFCnet
NOC
WiFi AccessPoint
Streaming Telemetry
Analytics and Measurement
Booth 5029
λ1 = 1.2 Tb/s
λ2 = 0.8 Tb/s
IOWN
Booth 5128
DALLAS
Open ROADM
Booth 5239
Swoblan Instruments
Booth 5235
AUREA
CORNING
Fiber Spools
Booth 5130
Abstracted Connectivity
Dark Fiber
1 Gigabit Ethernet
10 Gigabit Ethernet
100 Gigabit Ethernet
400 Gigabit Ethernet
DWDM
OFCnet Demonstration
OFC
OFC 2025 - OFCnet Architecture
OFCnet

ciena

ciena

Open for Collaboration

Rod Wilson - rwilson@ciena.com