



**AmLight<sub>EXP</sub>**  
Americas Lightpaths Express & Protect

**AmLight-Exp (NSF #OAC-2029283)**

***AmLight-Exp: Flexible control, deep visibility, and programmability at SC24***

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# Outline

- About AmLight Express and Protect (AmLight-Exp)
- Accomplishments since SC23
- AmLight-Exp at SC24
- NREs AmLight-Exp is supporting
- Roadmap for 2025

# About AmLight Express and Protect (AmLight-Exp)

# AmLight Express and Protect Project

- AmLight-ExP is an international R&E network purpose-built to enable collaboration among Latin America, Africa, the Caribbean and the U.S.
- Supported by NSF and the IRNC program under award #OAC-2029283
- Partnerships with R&E networks in the U.S., Latin America, Caribbean and Africa, built upon layers of trust and openness by sharing:
  - Infrastructure resources
  - Human resources

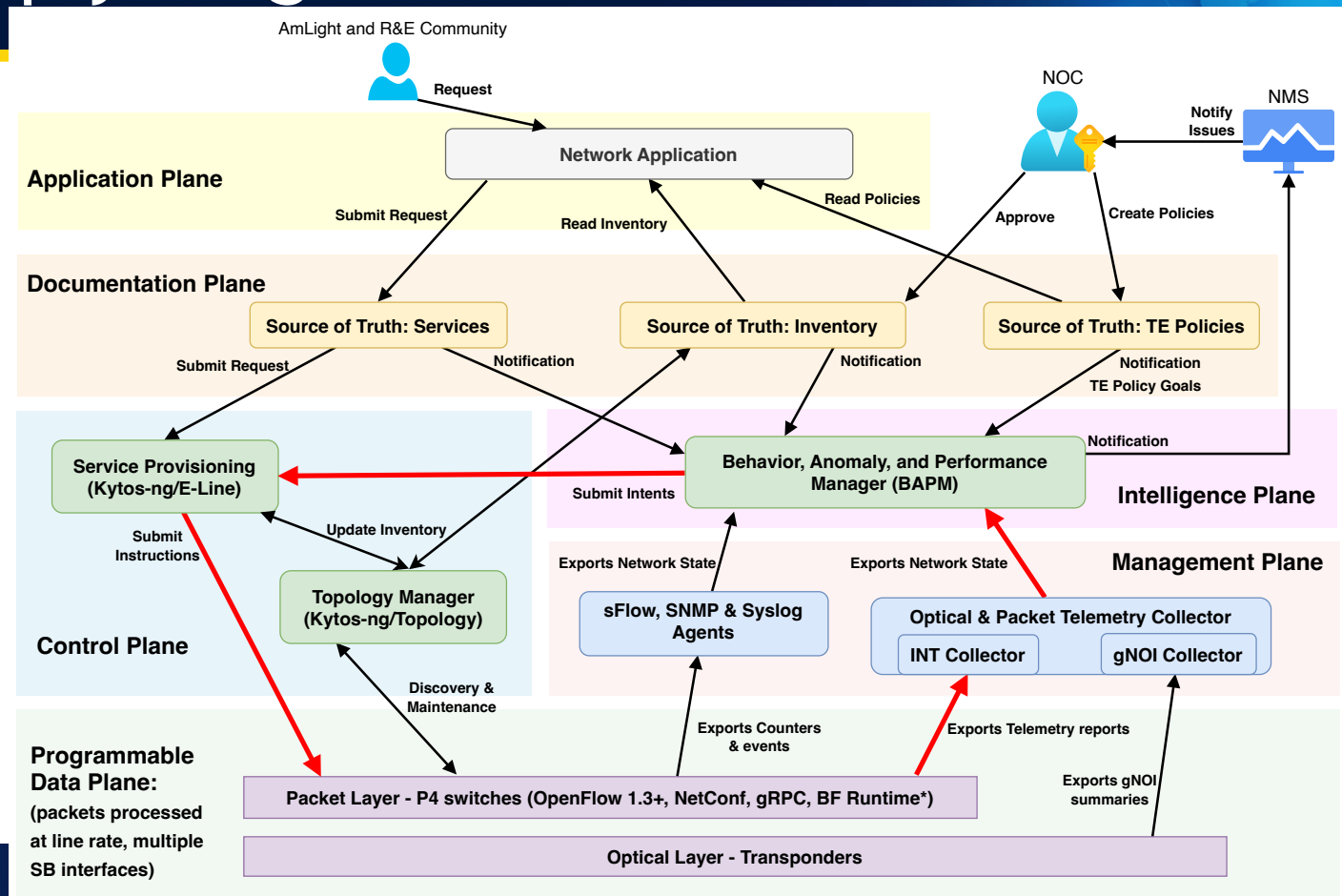




# AmLight's Deeply Programmable Network Stack

## Closed-Loop Orchestration:

- Fine-grained telemetry reports from the Data Plane
- Network State from the Management Plane
- Notifications result from the interpretation of network state by the Intelligence Plane
- Notifications and TE policy goals trigger intents to the Control Plane
- Instructions are submitted to the Data Plane to reprogram the forwarding path
- Network Verification and Packet Provenance
- Reduces the need for operator intervention



# Accomplishments since SC23

# Milestones accomplished since SC23: Network

- Expanded AmLight to Atlanta to connect to ESnet, FABRIC and Internet2
- Added 100G of dedicated capacity between Sao Paulo and Buenos Aires to support Vera Rubin, plus 300G of shared capacity for AmLight users (TANNAT)
- Added 200G of shared capacity between Sao Paulo and Boca Raton (SC24)
- Replaced legacy switches with high-capacity, INT-capable, programmable switches
- Increased compute (3) and storage (2) capacity for telemetry collection and analytics
- Enhanced microburst detection by VLAN and specific IP addresses (\*)
- Added telemetry to AmLight routers using the Juniper Telemetry Interface (JTI)

(\*) J. Bezerra, I. Brito, R. Frez and J. Ibarra, "An adaptive and efficient approach to detect microbursts leveraging per-packet telemetry in a production network," NOMS 2023-2023 IEEE/IFIP Network Operations and Management Symposium, Miami, FL, USA, 2023, pp. 1-6, doi: 10.1109/NOMS56928.2023.10154390.



# Milestones accomplished since SC23: SDN framework

- Deployed an orchestration solution for the SAX OXP in Fortaleza (for Layer 2 services)
  - Prior to this solution, the operation of the SAX OXP was managed manually
  - With the orchestration solution, SAX OXP added support for
    - dynamic provisioning of L2VPNs,
    - user-created VLAN services via web user interface,
    - remote topology monitoring, and
    - integration with the AutoGOLE/SENSE project for inter-domain provisioning.
- Optical & Packet Telemetry Collector (OPTC)
  - Developed a message broker solution to share network state reports consumed by multiple applications
  - Network state reports are consumed by applications monitoring traffic engineering components of the BAPM
- Behavior Anomaly & Performance Manager (BAPM)
  - The BAPM analyzes the network state against TE policies to interpret and respond to the network state
  - The BAPM focuses on guaranteeing that user policies and requirements are being fulfilled
  - A lesson learned from SC23 was the importance of traffic prioritization

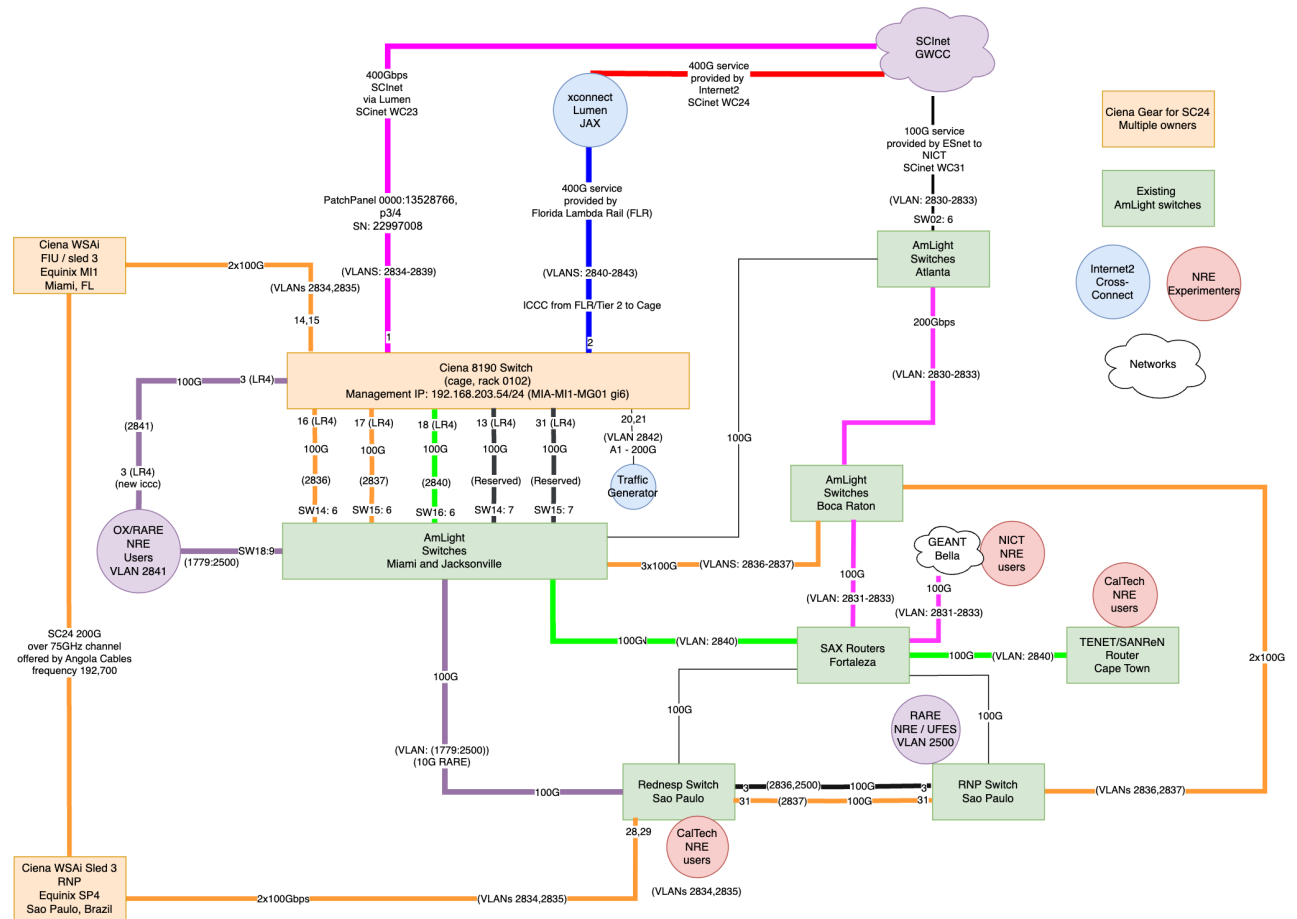
# New Queueing System for Traffic Prioritization

- As a result of bandwidth-based experiments and microbursts, a new traffic prioritization/queueing system was deployed at AmLight to minimize impact to production flows:
  - Queue 0: Less than Best Effort. Reserved for SC and other experiments.
  - Queue 1: Best effort traffic. By default, any L2VPN goes here.
  - Queue 2: Reserved for more than best effort. Not in use.
  - Queue 3: Reserved for Vera Rubin over shared links.
  - Queue 4: Reserved for deterministic monitoring (BERT).
  - Queue 5: Reserved for future use.
  - Queue 6 and 7: Reserved for management traffic.

# AmLight at SC24

# AmLight@SC24

- 2x400G to SCInet
- 2x100G for Rednosp
- Supporting NREs at Caltech, RARE, and NICT
- Coordinated efforts with Rednosp, RNP, RedClara, GEANT, TENET, Internet2, and FLR
- Many thanks to Ciena for the loaner equipment, to FLR, Internet2, and Lumen for the 400G links



# NREs AmLight-Exp is supporting

- *NRE-010 A Next Generation Multi-Tbps Campus and Global Network System for Data Intensive Sciences, FABRIC-Ciena, Booth #1940*
- *NRE-014 MMCFTP's Data Transfer Experiment Using Ten 100 Gbps Lines Between JAPAN and USA, NICT, Booth #3155*
- *NRE-015 High-Speed Data Transfers from South Africa to USA!*
- *NRE-022 AutoGOLE/SENSE: Edge Site Resource Integration with Network Services Department of Energy, Booth #3401*
- *NRE-025 HECATE Merges with PolKA AI-enabled Traffic Engineering for Data-intensive Science, California Institute of Technology, Booth #839*
- *NRE-029 Multi Domain Experiments Using ESnet SENSE on the National Research Platform/PacWave /FABRIC, FABRIC-Ciena, Booth #1940, John Graham*
- *NRE-031 High Performance Networking with the Sao Paulo Backbone SP Linking 8 Universities and the Bella Link*
- *NRE-036 PolKA Routing Approach to Support Traffic Steering for Data-intensive Science*

# Roadmap for 2025

- Deploy a Ciena Waveserver 6E at Sao Paulo, Fortaleza, and Boca Raton to activate a total of 1.1Tbps (currently we have 400G using Waveserver Ai)
- Upgrade 1x100G from Miami to Jacksonville to 1x400G
- Upgrade 1x100G from Jacksonville to Atlanta to 1x400G
- Activate the NA-REX connectivity: 1x400G to StarLight and 1x400G to PacificWave
- Add more functionality to the Intelligence Plane of the SDN framework architecture



# THANK YOU

