
# National Research Platform International Extensions

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# AmLight Express and Protect Project

- AmLight-ExP is an international R&E network 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 ExP
Americas Lightpaths Express & Protect
(NSF Award # OAC-2029283)



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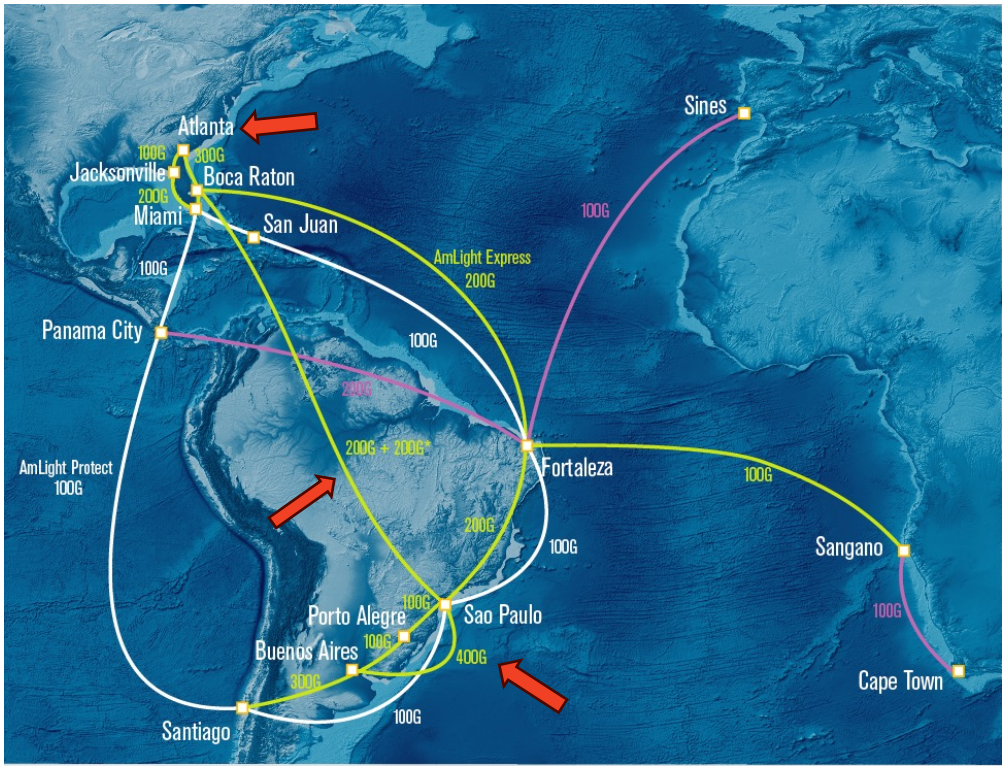
# AmLight-ExP Network Infrastructure

- 600G of upstream capacity between the U.S., Latin America, Caribbean and 100G to Africa
  - 2024: +400Gbps, and +200Gbps
- OXPs: Florida(3), Georgia (Atlanta), Brazil(2), Chile, Puerto Rico, Panama, and South Africa
  - New (2024): Argentina (Buenos Aires)
- Production SDN Infrastructure since 2014
- Deeply programmable across the network stack
  - Programmable P4 Data Plane
  - Open Source SDN Controller
  - Fine-grained telemetry
  - Run-time network verification
  - Closed-Loop Orchestration
- Highly instrumented for measurement
  - PerfSonar, sFlow, Juniper Telemetry Interface (JTI), In-band Network Telemetry (INT)



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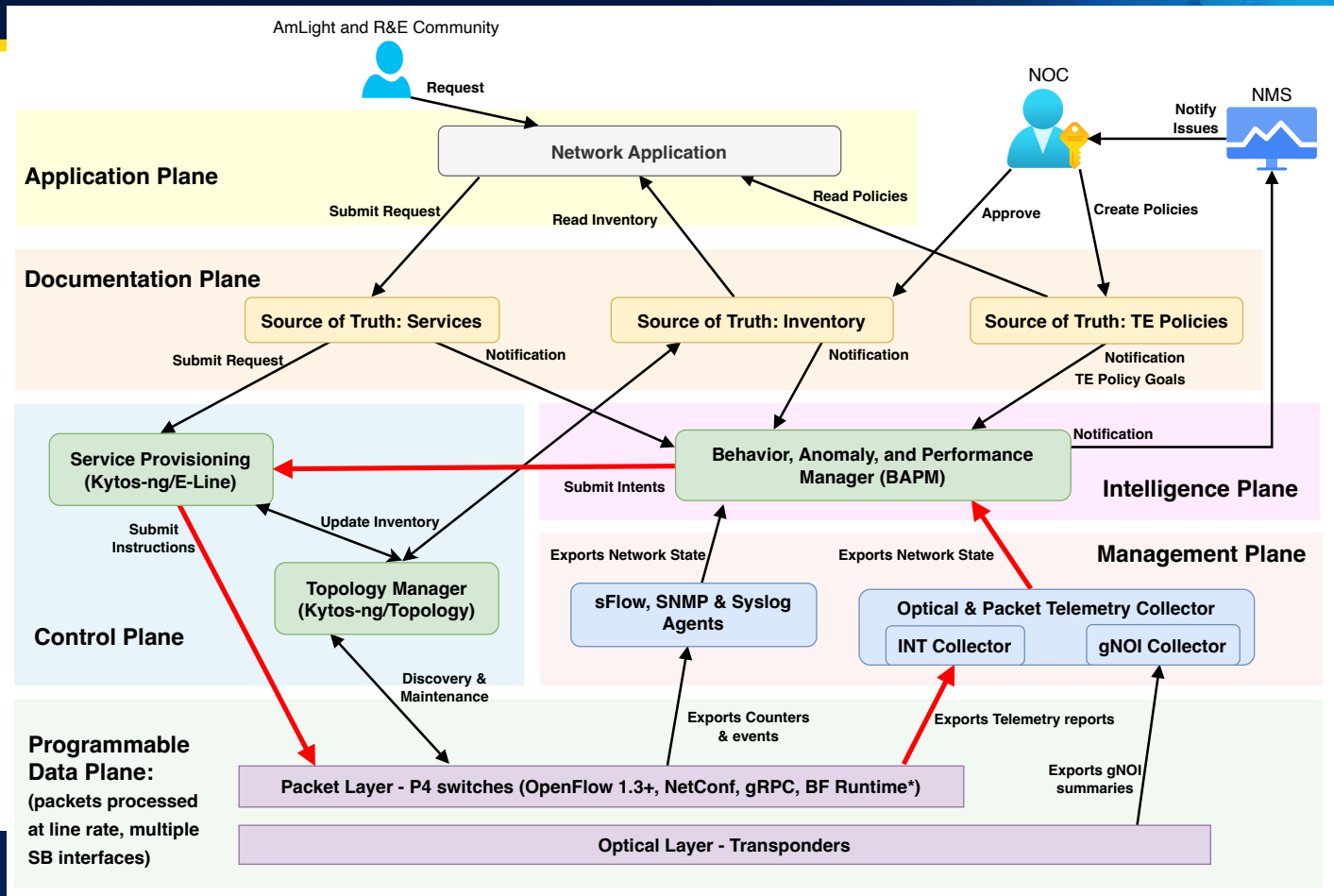
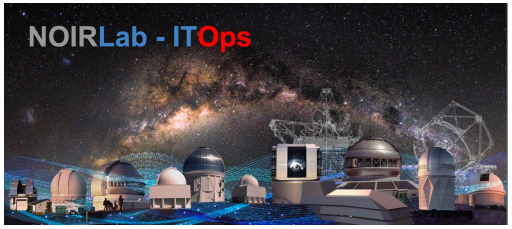
# AmLight's Deeply Programmable Network Stack

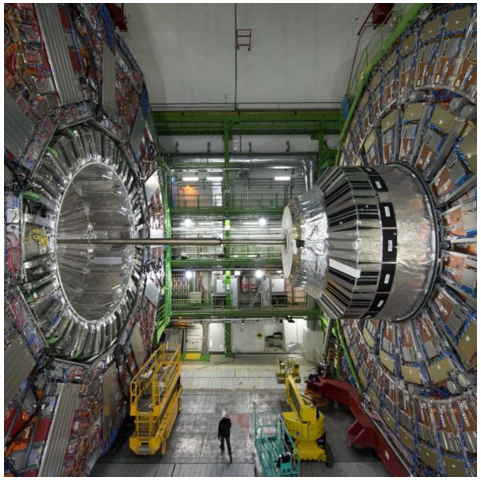
- Closed-Loop Orchestration:
  - Fine-grained telemetry reports from the Data Plane
  - Network State from the Management Plane
  - Notifications result from the interpretation of network state by the Intelligence Plane
  - Notifications and TE policy goals trigger intents to the Control Plane
  - Instructions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

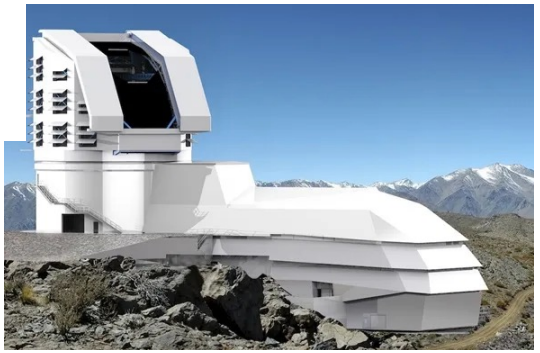


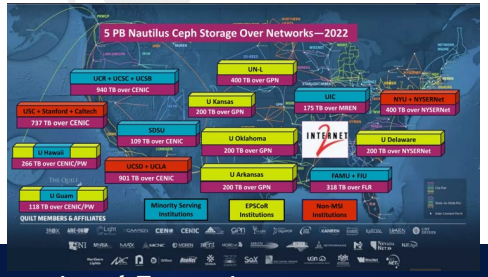
# Major Facilities

- NOIRLab
- ALMA
- Vera Rubin
- NRP
- FABRIC
- LHC
- OSG and PATh






*NRP International Extensions*

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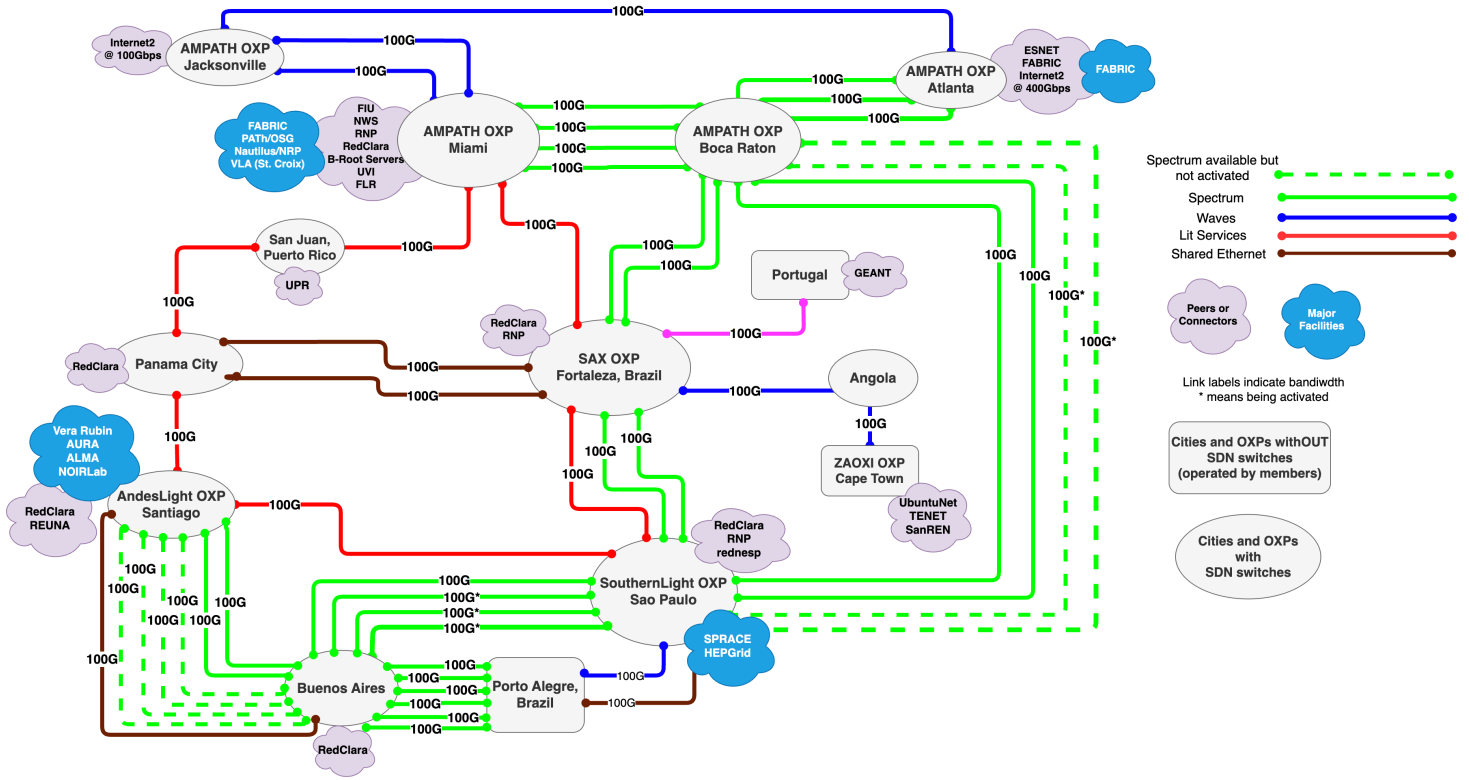
# Major Facilities supported by AmLight

- Major facilities are supported in Chile, Brazil, USVI, Florida, Georgia
- Multiple network diverse paths and bandwidth capacity are provisioned to provide high availability
- Open Exchange Points provide the flexibility to place computation and storage closer to major facilities



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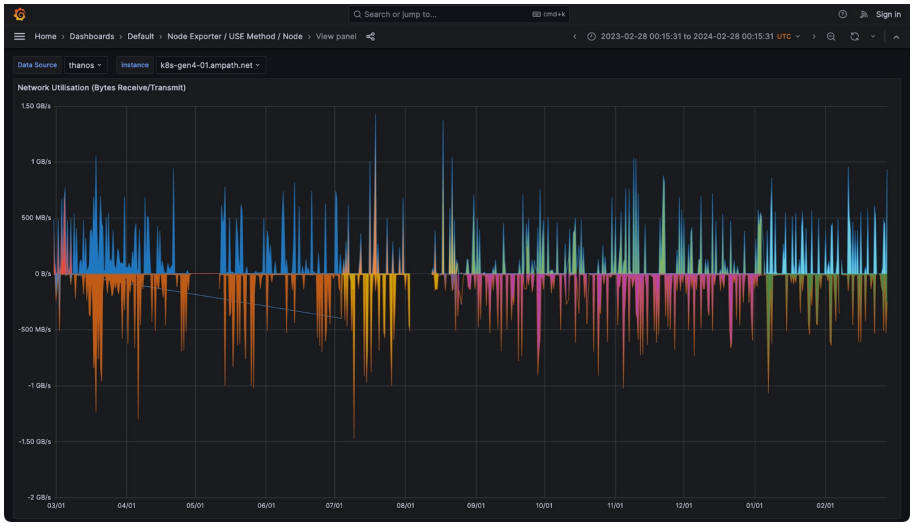
# GEN4 NRP Node at AMPATH

- GEN4 NRP node is at AMPATH supporting the Nautilus project
  - This node participates in the NRP eastern US storage pool
  - Operates as an OpenNSA AutoGOLE resource
- Two storage nodes were added last year to improve the NRP regional Ceph storage pool
- The additional storage capacity is helping universities in the southeast



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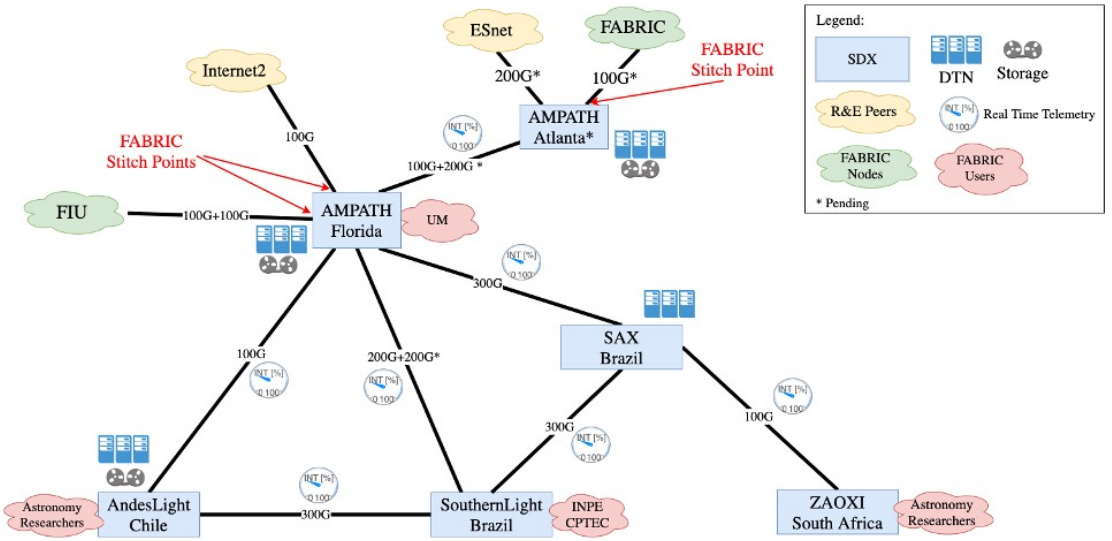
# Supporting FABRIC on AmLight and AtlanticWave-SDX

- FABRIC Edge node at FIU connects to Core node in Atlanta:
  - Primary path: 100G dedicated, layer 1, Miami to Altanta
    - Activation is pending a cross connect in Atlanta
  - Backup path: L2VPN over FLR
- Supporting FAB science drivers in Brazil and Chile by leveraging the AmLight network and the FABRIC Edge node at FIU
- Enabling researchers to create experiments with resources from both FABRIC and AmLight
  - Creating a Jupyter notebook library for AtlanticWave-SDX to integrate with FABRIC
  - Provide FABRIC experimenters access to network and computation resources at the SDXs
    - DTNs, INT Telemetry, etc.



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# THANK YOU

NSF

FIU
FLORIDA INTERNATIONAL UNIVERSITY

AMLIGHT
RESEARCH · EDUCATION COLLABORATION

AMPATH
PATHWAY OF THE AMERICAS

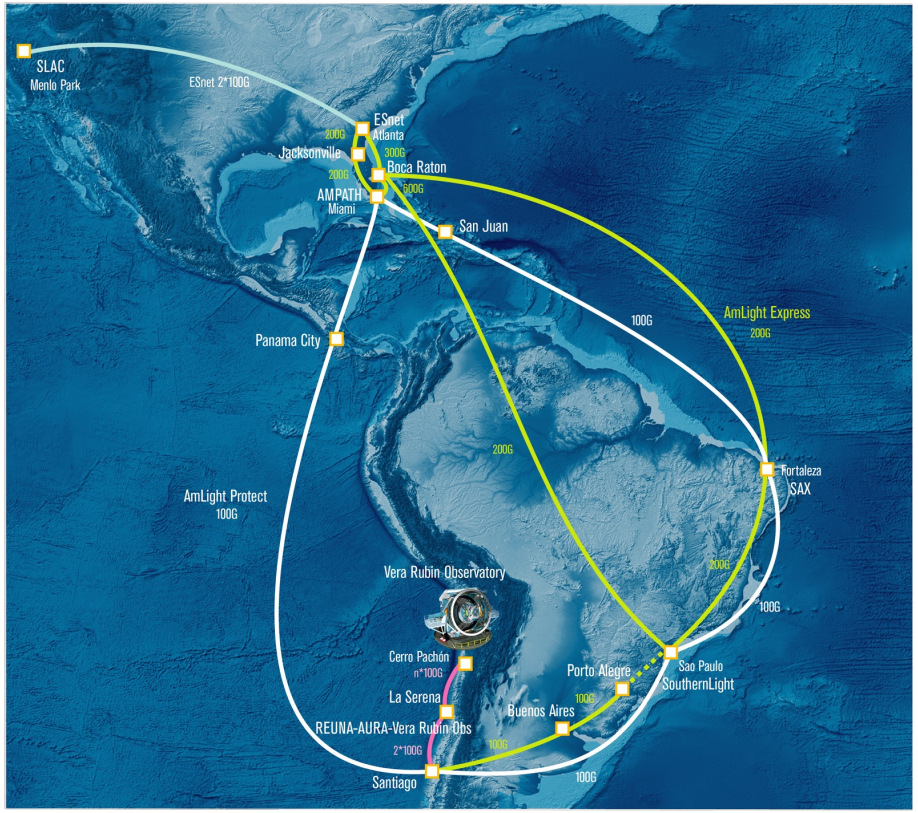
AmLight ExP
International Distributed Exchange Point

AtlanticWave SDX
INTERNATIONAL DISTRIBUTED SOFTWARE-DEFINED EXCHANGE

AARCLight
Americas Africa Research & eduCation Lightpaths

# Vera Rubin Observatory operation use case

- Vera Rubin is a large-aperture, wide-field, ground-based optical telescope under construction in northern Chile
- The telescope will take a picture of the southern sky every 27 seconds, and produce a 13 Gigabyte data set
- Each data set must be transferred to the U.S. Data Facility at SLAC, in Menlo Park, CA, within 5 seconds, inside the 27 second transfer window
- Challenges
  - High propagation delay in the end-to-end path
  - RTT from the Base Station to the USDF is approximately 180+ ms
  - 0.001% of packet loss will compromise the Rubin Observatory application
- Under Closed-Loop Control, AmLight's SDN infrastructure will continuously monitor the network substrate and reprogram the forwarding path in response to SLA requirements



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# AmLight supports SLA-driven science applications

- AmLight has many links and multiple paths between its sites:
  - From Chile to Atlanta, there are more than 28 possible paths to take
  - With its deep programmable SDN architecture, AmLight effectively load balances network services across network paths, while respecting user constraints and requirements

- AmLight supports SLA-driven packet-loss-intolerant and sub-second-response-time-expected science applications:
  - With per-packet telemetry and sub-second network profiling capacities, AmLight can react to network conditions under 1 second
  - With optical telemetry, AmLight can anticipate issues with its substrate and steer traffic out of the substrate before adverse events happen

- AmLight network engineers are focused on building networks that run autonomously:
  - With the closed loop control, some time-consuming operational activities will be performed without human intervention
  - With deep programmability, AmLight network engineers can verify that the network is responding to SLA requirements

# Outline

- About AmLight Express and Protect (AmLight-ExP)
- Major Facilities Supported by AmLight-ExP and AtlanticWave-SDX