

AmLight_{EXP}
Americas Lightpaths Express & Protect

AmLight-ExP (NSF #OAC-2029283)

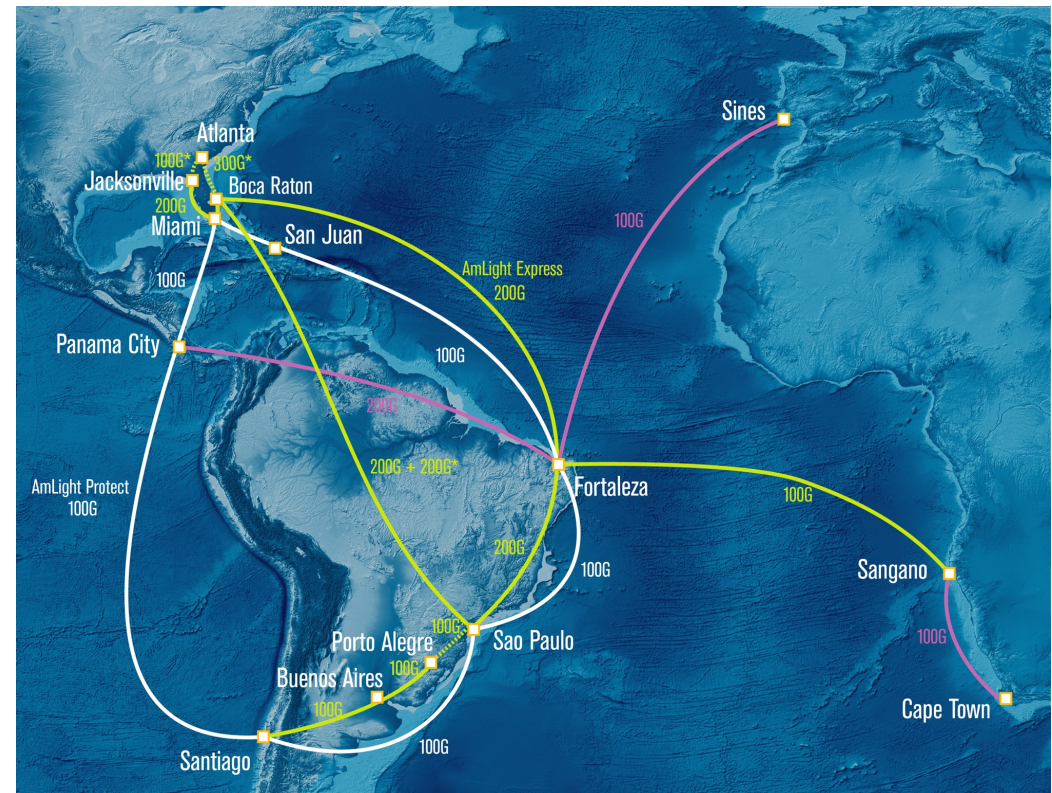
AtlanticWave-SDX (NSF #OAC-2029278)

8th Annual TPRE Meeting
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AmLight Express and Protect (AmLight-ExP) Network Infrastructure

- 600G of upstream capacity between the U.S., Latin America, Caribbean and 100G to Africa
 - Blend of Spectrum and Leased Capacity
- OXPs: Florida(3), Brazil(2), Chile, Puerto Rico, Panama, and South Africa
- Production SDN Infrastructure since 2014:
 - Orchestrators: OESS and Kytos-ng
 - OpenFlow 1.0 and 1.3 Southbound Interfaces
- Programmable Data Plane:
 - P4 -> In-band Network Telemetry (INT)
 - 21 programmable devices in production
- Highly instrumented:
 - PerfSonar, sFlow, Juniper Telemetry Interface (JTI), INT



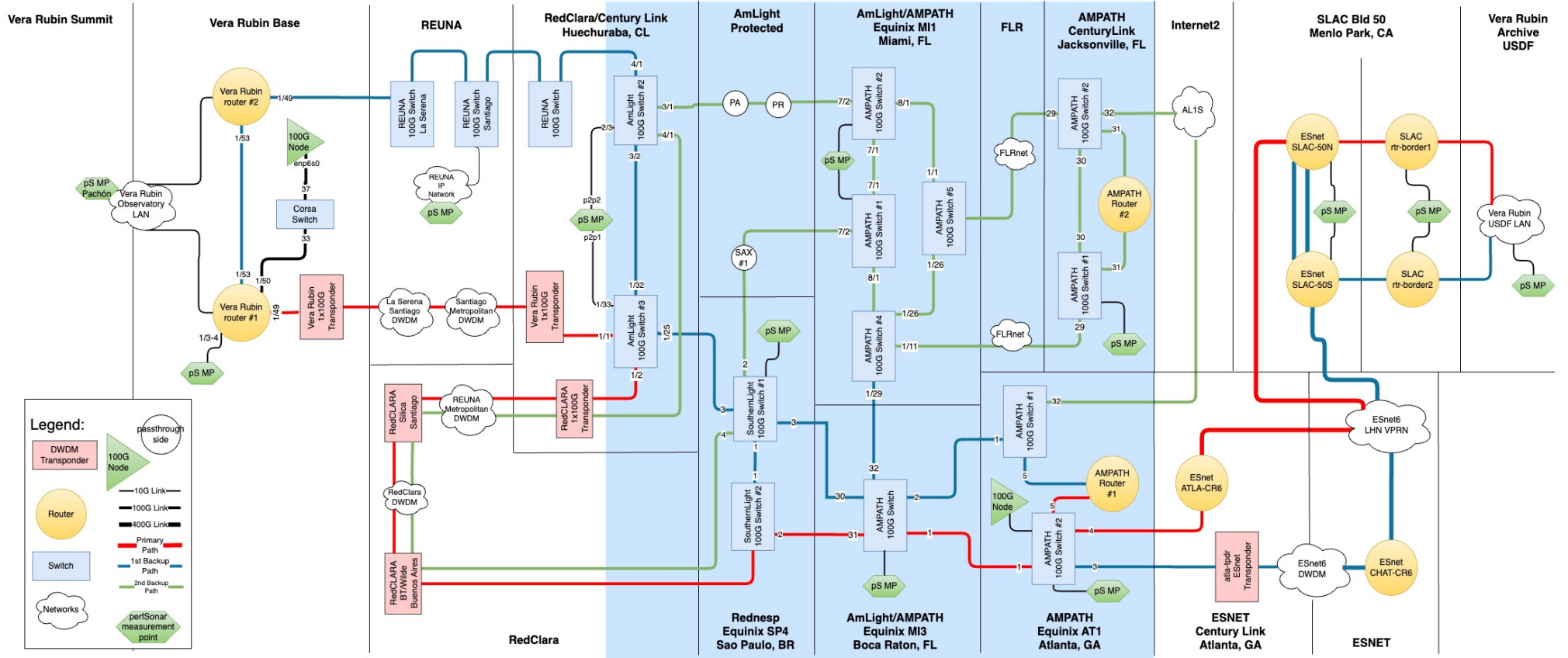
2023 Roadmap (sample) for Improving the AmLight network infrastructure

- Deploying two NoviFlow switches in San Juan
- Decommissioning Brocade and Dell switches
- Deploying Juniper routers in San Juan and Santiago to enhance routing
- Commissioning AMPATH Atlanta OXP
- Activating spectrum between Boca Raton and Atlanta
 - Supports Vera Rubin, FABRIC, and LHC
- Increasing the spectrum from Boca Raton to Sao Paulo from 75 GHz to 112.5 GHz
 - Increases bandwidth capacity from 200G to 400G
- Activating 100G link between Sao Paulo and Buenos Aires
 - Provides 100G dedicated primary path for Vera Rubin
- Activating 100G link between Miami FABRIC Edge node and Atlanta FABRIC Core node

Versioning

Author: NET team
Last update: Apr 21th, 2022

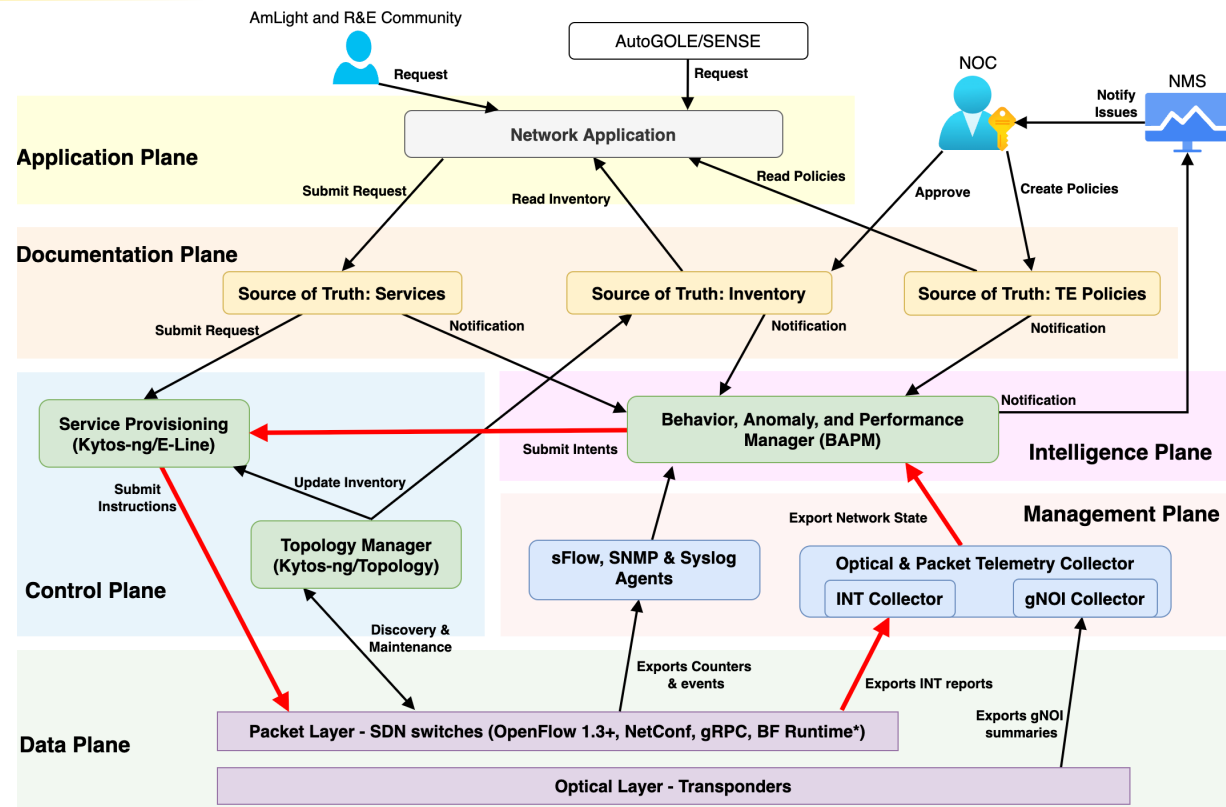
Vera Rubin Observatory LHN - FY2023



Innovating the Network for Data Intensive Science 2019

Evolving the AmLight-ExP SDN framework

- Evolving the SDN framework with six SDN planes to autonomically regulate AmLight-ExP network:
- **Data Plane:**
 - Exports counters from the Optical and Packet layers to the Management Plane
- **Control Plane (CP):**
 - Topology discovery and maintenance (Topology Manager)
 - Service Provisioning (submits instructions to Data Plane)
- **Management Plane:**
 - Exports network state to the Intelligence Plane:
 - Sampling counters; Optical and Packet telemetry
- **Intelligence Plane:**
 - Correlates events with inventory and traffic engineering policies from the Documentation Plane to learn the network state
 - Creates a closed-loop control for self-optimization
 - Submits requests to the CP if non-compliance
- The first Autonomic Function planned is to support L2VPNs fully managed by this architecture



2023 Roadmap for the AmLight SDN network

- Deploy a new release of the AmLight SDN Control Plane containing software releases 2022.1, 2022.2 and 2022.3
 - A new instance of the CP will run from Miami, orchestrating Noviflow switches in Jacksonville, Miami, Boca Raton, Sao Paulo, Santiago, and Panama City
- Release 2023.1 of Kytos-ng SDN Controller
 - Enhances support for In-band Network Telemetry (INT), Bidirectional Forwarding Detection (BFD), and for VLAN ranges for point-to-point Ethernet Virtual Circuits (EVCs)
- Assess the complexity of adding Barefoot Runtime (BFRuntime) as a southbound interface for provisioning
 - Objective is to evaluate the effort needed to support P4 natively and decommission OpenFlow in the near future

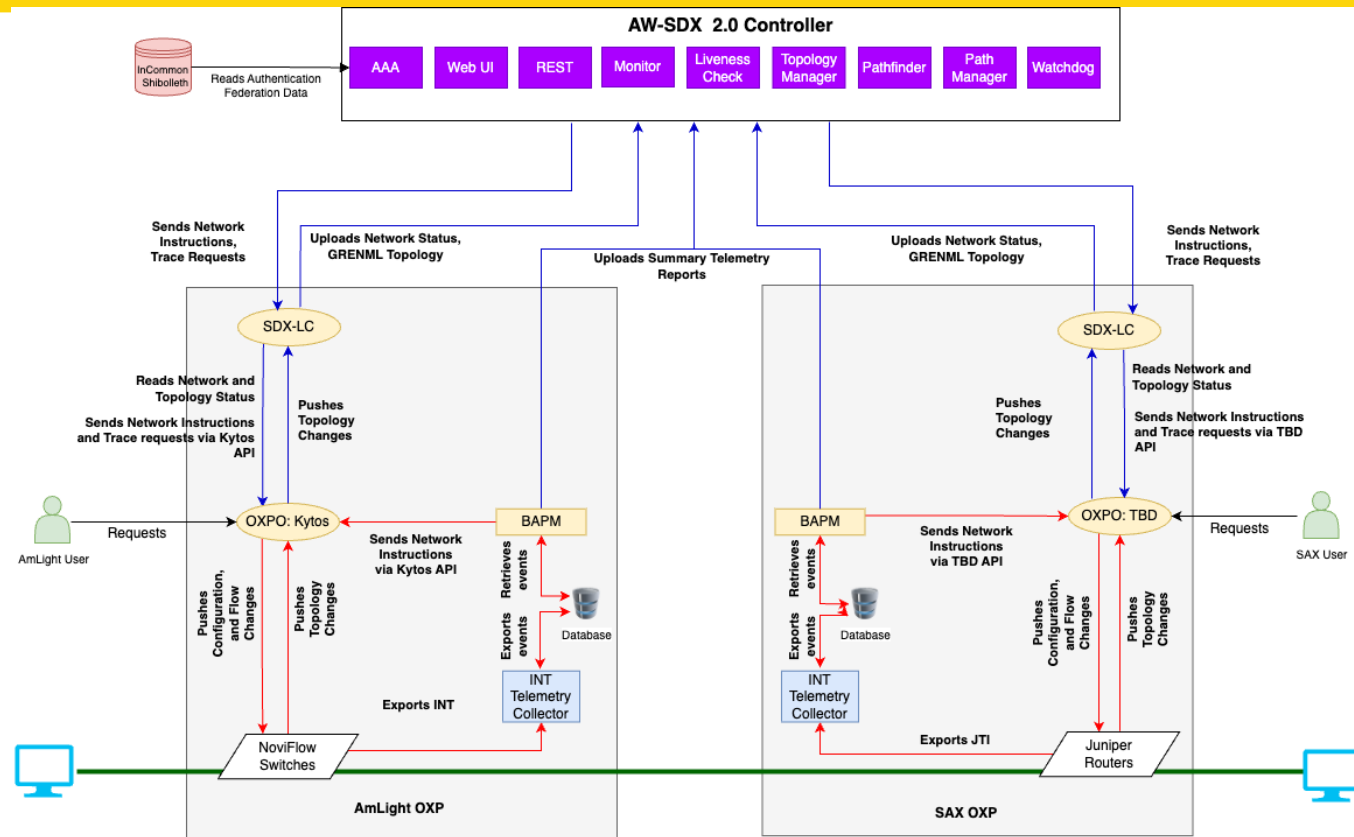
AtlanticWave-SDX: Closed-loop Orchestration

■ Per-OMP Orchestration:

- OXP chooses its Orchestrator to support its operation
- OXP decides what Autonomic Functions to support

■ Inter-Domain Orchestration

- SDX defines interfaces and data models for OXPs
- OXPs produce and consume data from the SDX Controller
- SDX creates a full topology
- SDX supports all inter-domain network functions



2023 Roadmap (sample) for the AtlanticWave-SDX

- **Inter-domain provisioning:**
 - Design and implement the SDX controller API for MEICAN data consumption
 - Add support for CILogon to MEICAN
- **SDX Controller:**
 - Implement optimal end-to-end connection protection and restoration algorithms
 - Implement time series analysis and ML decision functions for re-optimization and self-healing actions
- **Path Computation Element (PCE):**
 - Add TE optimization component to compute two or more disjoint paths between two endpoints
 - Integrate the PCE functions with the SDX controller
- **Data Model:**
 - Define the BAPM data model for the telemetry and monitoring information between the OXP BAPM and the SDX Controller middleware
 - Define data models for Layer-3 services
- **Interfaces:**
 - Enhance the message queue functions to support communications between the OXP BAPM and the SDX Controller



THANK YOU

