



South American - African Astronomy Coordination Committee (SA3CC) Meeting 2026



AmLight: Updates about Connectivity and Innovation

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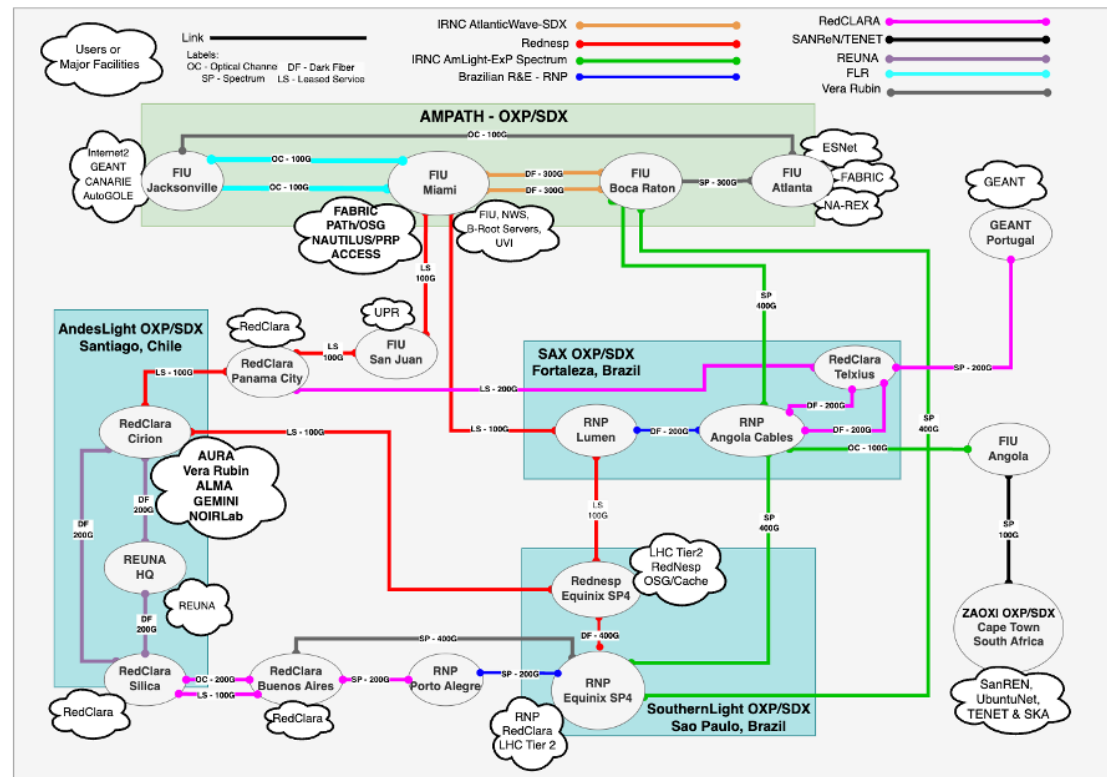
AmLight: The Next Frontier: 2026-2030 Goals

- **To maintain the existing network infrastructure** that connects the U.S. to the science facilities and instruments, data sources, and research groups in Latin America and Africa
 - To continue supporting the operation, automation and integration of the R&E OXPs connected to and peering with AmLight
- **To guarantee new levels of observability, programmability and integration** with science workflows and testbeds, and data transfer performance
 - To expand the portfolio of network datasets to support the ML/AI communities
- **To introduce new paradigms and components to enhance the AmLight network**
- To continue supporting network experimentation through integration with science communities such as SA3CC and GNA-G, and testbeds such as FABRIC, RARE, and AutoGOLE/SENSE

Maintaining the AmLight Physical Infrastructure

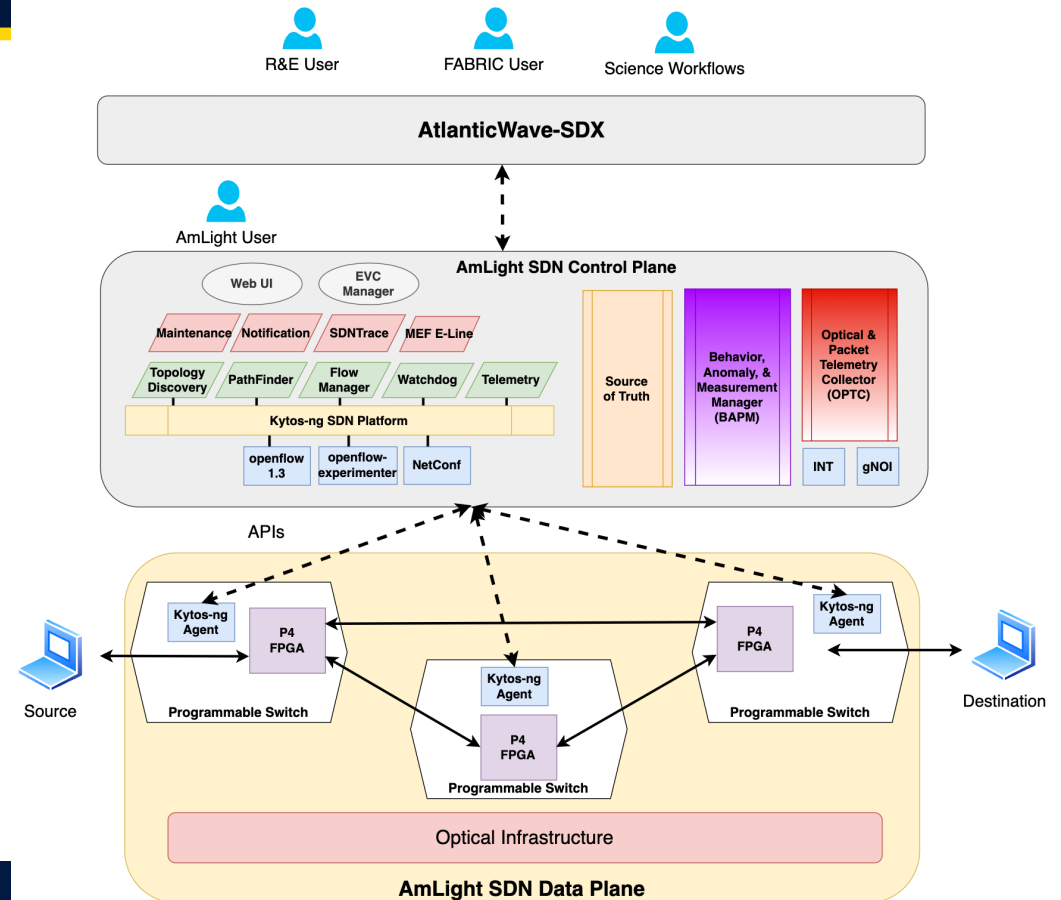
AmLight Physical Infrastructure in numbers:

- Total capacity: ~5 Tbps
 - **Breaking News: 1Tbps between US and Latin America**
 - **+3x400G to NA-REX: WIX, StarLight, and PacificWave**
 - 41x 100G network links connecting 18 datacenters in 7 countries
 - ~38 network devices
- IT infrastructure for management:
 - VMware cluster, Storage nodes, Servers, DTNs, and NAS
- Network measurement instrumentation
 - PerfSONAR nodes, Traffic Generator, **SmartNICs**, and Programmable switches



Maintaining the AmLight Software Infrastructure

- AmLight operates at multiple layers to support its community:
 - **Inter-domain** for integration with remote instruments, OXPs, testbeds, and science workflows
 - **AtlanticWave-SDX**
 - **Intra-domain** for an efficient network provisioning with sub-second service restoration
 - Packet Layer and Optical Layer
 - **Kytos-ng**, In-band Network Telemetry (INT), Traffic Engineering, and policies



AmLight: 20+ Years of Innovation

- 2005-2010: Building international R&E connectivity
- 2010: Pioneer using coherent alien waves on legacy submarine systems
- 2013: Dynamic circuits using OSCARS / NSIv2 in production
- 2014: Migration to Software-Defined Networking (SDN) and network slicing
- 2018: Acquired optical spectrum on a submarine system (Monet)
- 2020: Programmable switches with P4 and per-packet network telemetry (INT)
- 2021: Deployment of a homemade network orchestrator: Kytos-ng SDN Platform
- 2024: Use of traffic generators to continuously evaluate link quality
- 2026: Activated a 1Tbps optical channel between the U.S. and Latin America
- *What should we do next?*

Enters...



OpsSteward: AI-Native Network Operations Platform

- AI-driven operational intelligence platform to support **SLA-based science drivers** and R&E networks
 - Transforms operational data into intelligent network operations
- Designed for large-scale SDN, optical, and multi-domain infrastructures
 - *Integrates* topology, telemetry, logs, services, and operational context into a unified knowledge graph
 - *Combines* Real-time streaming telemetry, Graph intelligence (Neo4j), Retrieval-Augmented Generation (RAG), and locally-hosted LLMs (vLLM)
 - To build AI-assisted operational workflows
- Built to support:
 - Faster troubleshooting, Intelligent automation, root-cause analysis, SLA awareness, and autonomous operations
- Developed for environments where reliability, observability, and operational scale are critical

OpsSteward: How it works

- OpsSteward:
 - Consumes all telemetry, policies, events, relationships, Source of Truth, and inventory
 - Reports inconsistencies
 - Correlates events
 - Notify operators
 - Create MOPs
 - Supports report-writing activities
- Operational answers cite the system of record, not model memory.
- OpsSteward is not only chat. It is an evidence layer over network operations.
- **Operational Intelligence Through Context and Reasoning**

OpsSteward

AI-Powered Network Operations Platform

WHO USES IT

- NOC Engineers
- Network Operators
- Automation & AI Agents
- External Systems & Integrations

WAYS TO INTERACT

- Web UI (Dashboard)
- Chat / Natural Language
- API Clients
- Automation Workflows

WHAT THEY GET

- Operational Insights
- Topology & Path Intelligence
- RCA & Incident Analysis
- Recommendations & Automations

DATA & TELEMETRY SOURCES

- nautobot** (Network Source of Truth)
 - Inventory
 - IPAM
 - DCIM
 - Relationships
- kytos ng** (SDN Controller & Network Services)
 - Topology
 - Intent
 - Services
 - Flows
- HPE Juniper networking** (Network Infrastructure)
 - Routers
 - Switches
 - Telemetry
 - Streaming Data
- Other Sources**
 - Syslog
 - SNMP
 - NetFlow/IPFIX
 - Telemetry (gNMI, sFlow, etc.)

EVENT STREAMING & INGESTION

Apache **kafka**

- High-throughput
- Real-time Streaming
- Durable Event Bus
- Decoupled Architecture

Schema Registry & Connectors

Stream Processors

KNOWLEDGE GRAPH & OPERATIONAL INTELLIGENCE

neo4j

Rich Relationships | Temporal Context | Graph Analytics | Impact Analysis | Root Cause Traversal

Devices, Interfaces, Links, IP Prefixes, Locations, Services, Paths, Telemetry, Events, Incidents, Policies & Intent

OPSTEWARD MODULES

- TopoSteward**
 - Topology Ingestion
 - Topology Validation
 - Path Computation
 - Impact Analysis
- LogSteward**
 - Log Ingestion
 - Parsing & Normalization
 - Correlation
 - Anomaly Detection
- HealthSteward**
 - Health Monitoring
 - KPI & SLO Tracking
 - Alerts & Notifications
 - Predictive Insights
- IntentSteward**
 - Intent Validation
 - Policy Compliance
 - Drift Detection
 - Remediation Suggestions
- (More Stewards)**
 - Extensible Framework
 - Domain-specific Stewards
 - Custom AI Agents

AI & INTELLIGENCE LAYER

RAG PIPELINE

Chunking & Indexing → Vector Embeddings → Vector Store (Embeddings)

Ollama (Local LLMs, Privacy First) ↔ Models for Reasoning, Analysis & Generation

ARTIFICIAL INTELLIGENCE

- LLM Reasoning
- Pattern Detection
- Prediction
- Root Cause Analysis
- Anomaly Detection
- Natural Language Understanding

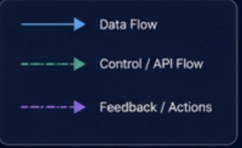
API & SERVICE LAYER

FastAPI

- RESTful APIs
- Authentication & Authorization
- Rate Limiting
- OpenAPI / Swagger
- Real-time APIs (WebSockets)
- Programmatic Access
- Integration Gateway
- Automation Hooks

AUTOMATION & ACTIONS

- Ticketing Systems
- ChatOps (Teams, Slack)
- Runbooks & Workflows
- Network Automation
- External Systems



OBSERVABILITY, SECURITY & GOVERNANCE

- Monitoring (Prometheus/Grafana)
- Logging (ELK / Loki)
- Security (RBAC, TLS, Audit)
- Data Governance & Retention
- Backup & Disaster Recovery

DEPLOYMENT OPTIONS

- On-Premises
- Private Cloud
- Hybrid
- Public Cloud

KEY BENEFITS

- ✓ Holistic Network Visibility
- ✓ AI-Powered Insights
- ✓ Faster Incident Resolution
- ✓ Proactive Operations
- ✓ Automation at Scale
- ✓ Open & Extensible
- ✓ Built for Research Networks

Quick Demo



THANK YOU

