AmLight ExP
Americas Lightpaths Express & Protect

AmLight Express and Protect (AmLight-ExP), #OAC-1451018

LSST Workshop: *AmLight-ExP updates*

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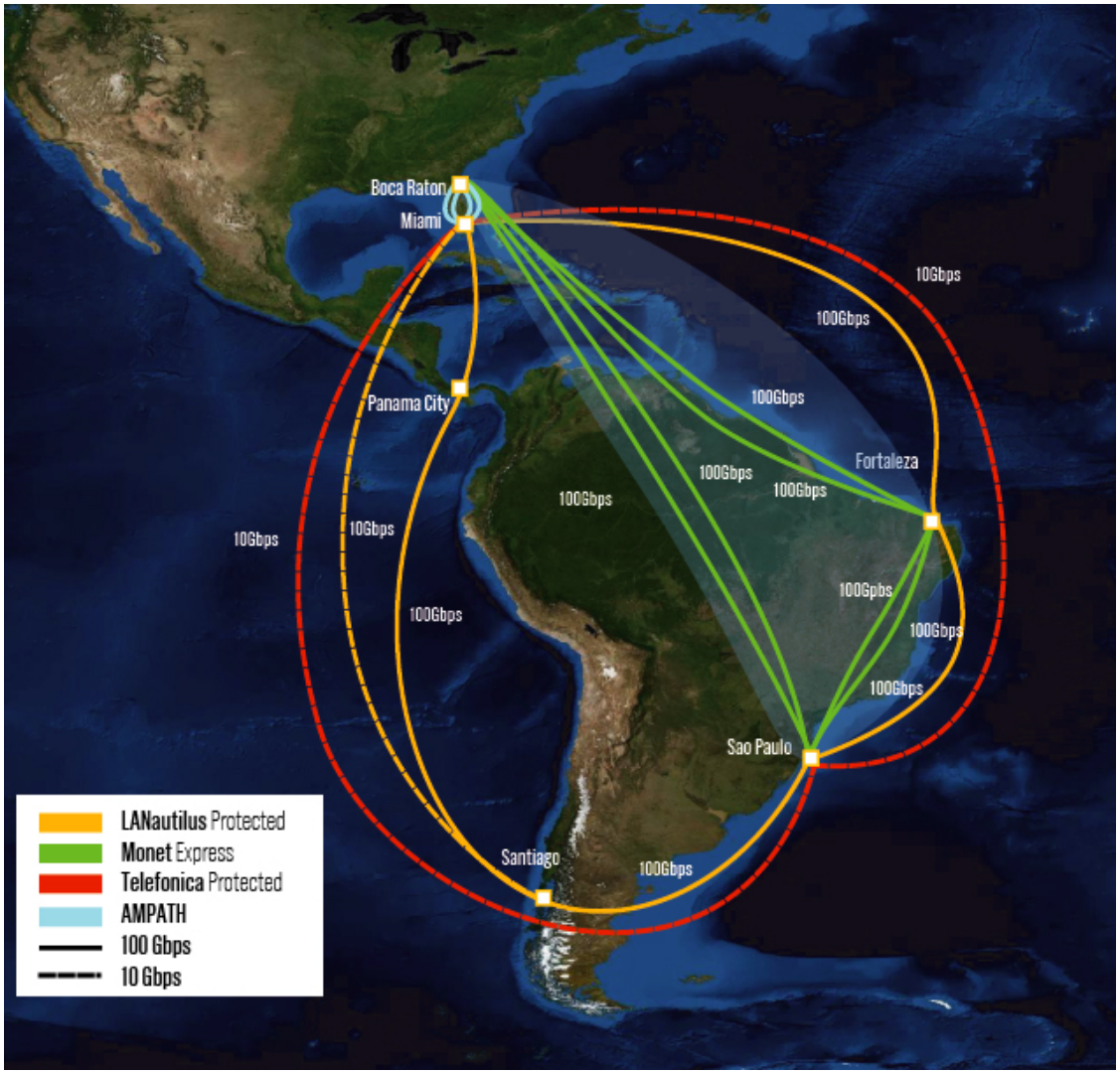
Outline

- AmLight-ExP Topology
- Current Status
  - Network infrastructure
  - Monitoring and Measurement
- AmLight-INT project
- Timeline Current to 2022

AmLight Express and Protect Network Infrastructure

- Express Ring: Boca Raton, Fortaleza, Sao Paulo
  - 6 (green lines) x 100G links
    - 4 managed by RNP
    - 2 managed by FIU/ANSP/LSST
- 100G Protect Ring: Miami-Fortaleza, Fortaleza-Sao Paulo, Sao Paulo-Santiago, Santiago-Panama, and Panama-Miami (solid orange)
- 10G ring from Miami-Sao Paulo-Miami for protection (red dashed)
- 10G Miami-Santiago for protection (orange dashed)
- 100G and 10G rings are diverse, operating on multiple submarine cables
- Total upstream capacity presently at 630Gbps!



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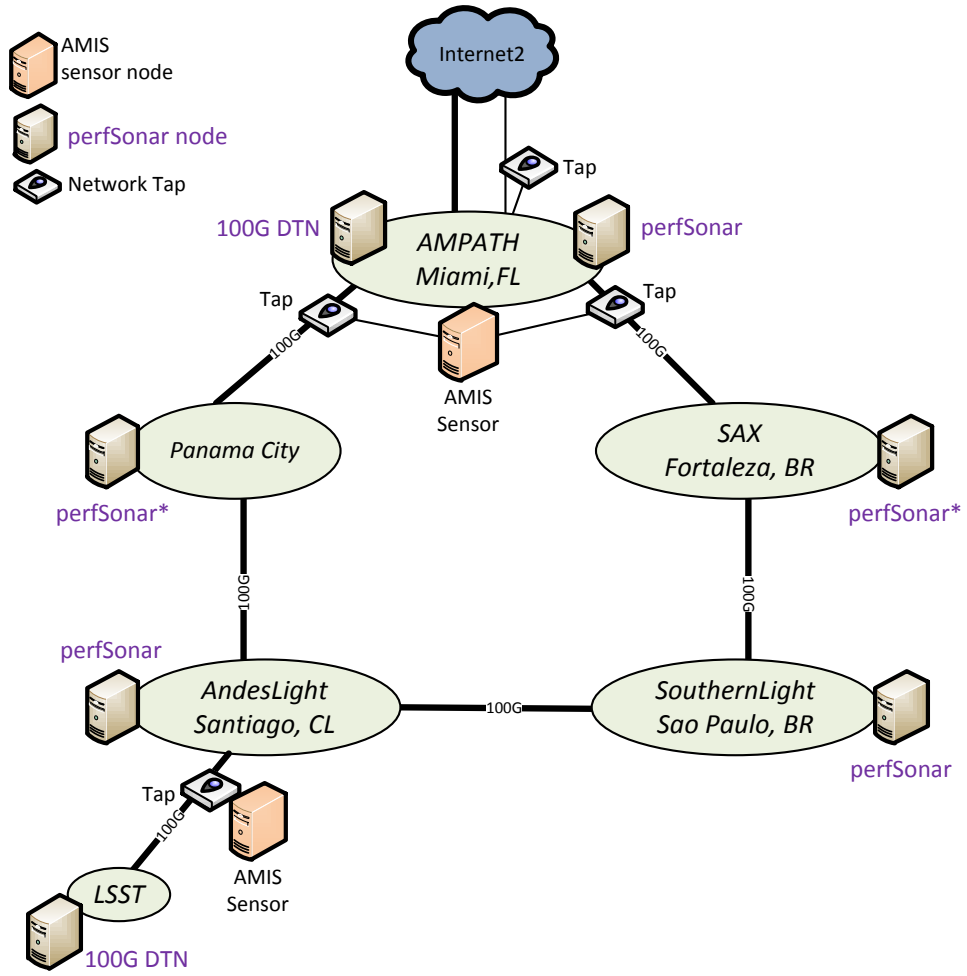
Monitoring, Measurement and Troubleshooting

- Each AmLight PoP has a perfSonar node with two 10G NICs
  - Maddash portal available
  - 5 perfSonar nodes in operation
  - Sixth node being installed in Fortaleza
- Three 100G port mirrors for monitoring and troubleshooting
  - Two in Miami
  - One in La Serena
- Two 100G DTNs for high bandwidth experiments and measurements
  - La Serena and Miami



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AmLight-INT Project

- AmLight-INT (In band Network Telemetry) is a new project, funded by NSF, that will include telemetry functions in the AmLight network
- Focuses on improving Operations, Administration and Maintenance (OAM) methods for the AmLight-ExP SDN production environment
- Provides a response to the LSST SLA requirements by enabling real-time network troubleshooting functions
- LSST's network services requests and requirements are challenging
  - Intensive data movement
  - Guaranteed services for delivery of 13GB images

Troubleshooting a multi-domain production SDN backbone

- Capturing network transient events is challenging
  - Network transient events refer to network anomalies that are difficult to trace, but cause disruption, such as microbursts, intermittent congestion, etc.
  - Still using 20-year old legacy technologies (Traceroute, ICMP, SNMP, NetFlow, RMON, sFlow)
    - Sampling is not good enough for observing network transient events
- Identifying microbursts or isolating packet loss in real time is not feasible with current technology
  - Monitoring flows in real time overloads network resources
    - Traditional methods are limited by CPU-based control planes (e.g., perfSonar)
      - Cannot keep up with real-time requirements
    - Polling SNMP or OpenFlow counters is costly in sub 30 second intervals, because of CPU consumption
- Troubleshooting activities to isolate packet loss can take 3-6 weeks

What is In-band Network Telemetry (INT)

- INT is a framework designed to allow for the collection and reporting of network state, by the data plane, without requiring intervention or work by the control plane
- Network Telemetry overcomes limitations imposed by legacy technology:
  - More metrics and granularity beyond what traditional networking monitoring solutions can provide
  - Sub-second data gathering
  - Streamed network telemetry for useful microburst detection and queue utilization at a sub-second interval
  - Complete view of network state in the flow's path

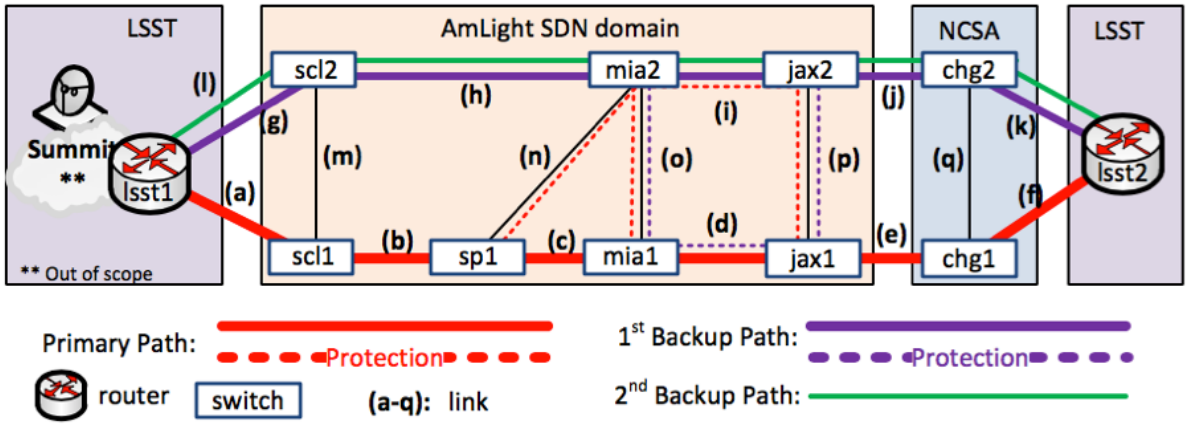
LSST Use Case for AmLight-ExP INT Project

- Every 27 seconds throughout the night, LSST will take a 6.4GB picture of the sky, process it, generate transient alerts (6.3GB) from this picture, and then send a 13GB data set to NCSA, at Urbana-Champaign, Illinois
  - From the 27-seconds window, only 5 seconds are available for data transmission
  - Multi-traffic types with different priorities (db sync, control, general Internet traffic) must be supported
  - A 0.001% of packet loss will compromise the LSST application.

- Packet loss isolation will have to be handled in real-time.
- Strict SLA:

  MTBF (180 days in a year)

  MTTR (48 hours)



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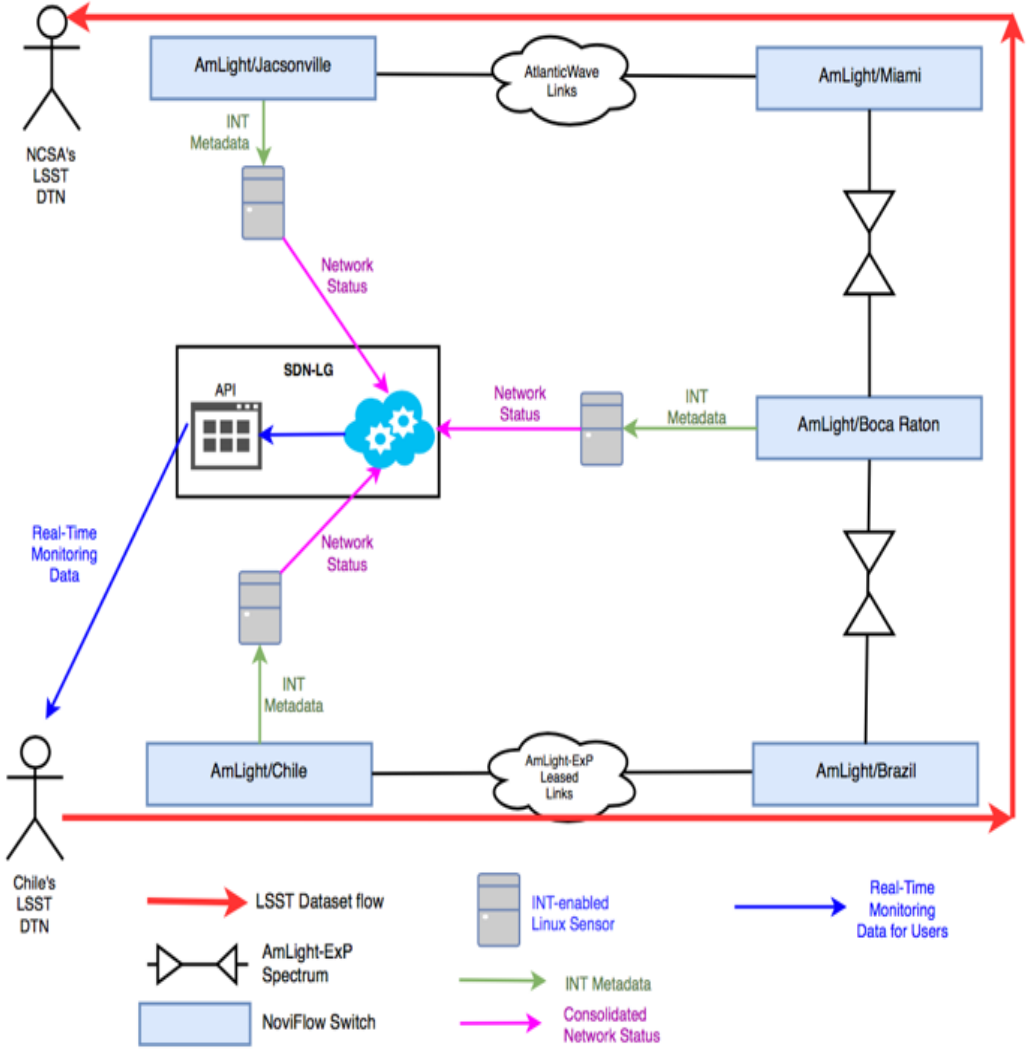
AmLight-INT Architecture

- INT-capable SDN switches will export INT metadata of pre-selected SDN circuits defined by the AmLight-ExP SDN controller
- INT-enabled Linux Sensors, installed at multiple sites, will collect the INT metadata directly from the INT-capable switches
- Once INT metadata is collected, it will be processed, analyzed, consolidated, and exported to the AmLight SDN-LG
- The AmLight SDN-LG will receive feeds from all INT-enabled Linux Sensors then consolidate, store the network status data
- Users interested in the network status data will be able to import it using the SDN-LG API



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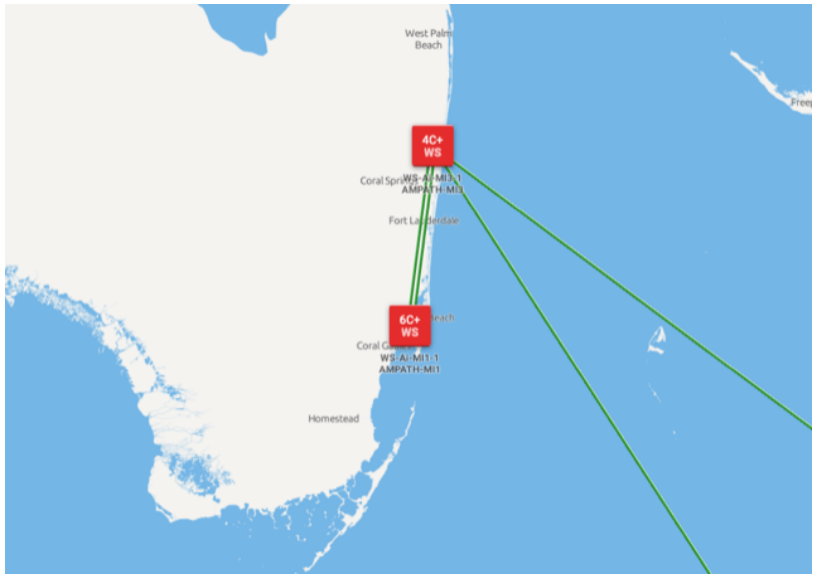
Timeline for AmLight-ExP

- 2019
  - Spectrum activation, Boca Raton to Sao Paulo, (completed)
  - Aug 27 - configured the Miami-Boca segment over CrownCastle to transport the Monet spectrum to Miami! RNP is installing a new 100G switch at SouthernLight to receive these new links.
- 2020
  - Activate spectrum, Sao Paulo to Santiago
  - Deploy new SDN Controller for AmLight-ExP
  - Activate 200Gbps, Atlanta to Chicago, Esnet
- 2021
  - Activate spectrum, Boca Raton to Atlanta
  - Deploy AmLight-INT in production
- 2022
  - LSST Operations starts



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THANK YOU!

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