AmLight Express and Protect (AmLight-ExP) update

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What is AmLight Express and Protect (AmLight ExP)?

- AmLight-ExP project (2015-2020) builds upon the achievements of the AmLight project

- Introduces spectrum capacity between the U.S. and Brazil

- Continues evolving a rational network infrastructure, using both spectrum and leased capacity

AmLight-ExP Today

- 100G Miami-São Paulo, Atlantic

- 100G Miami-São Paulo, Pacific

- 4x10G links, landings in São Paulo, Fortaleza, Santiago

- 240G of aggregate bandwidth capacity

- 100G ring to include Santiago and Fortaleza in March 2017

  - Eliminating 10G links in Santiago and Fortaleza
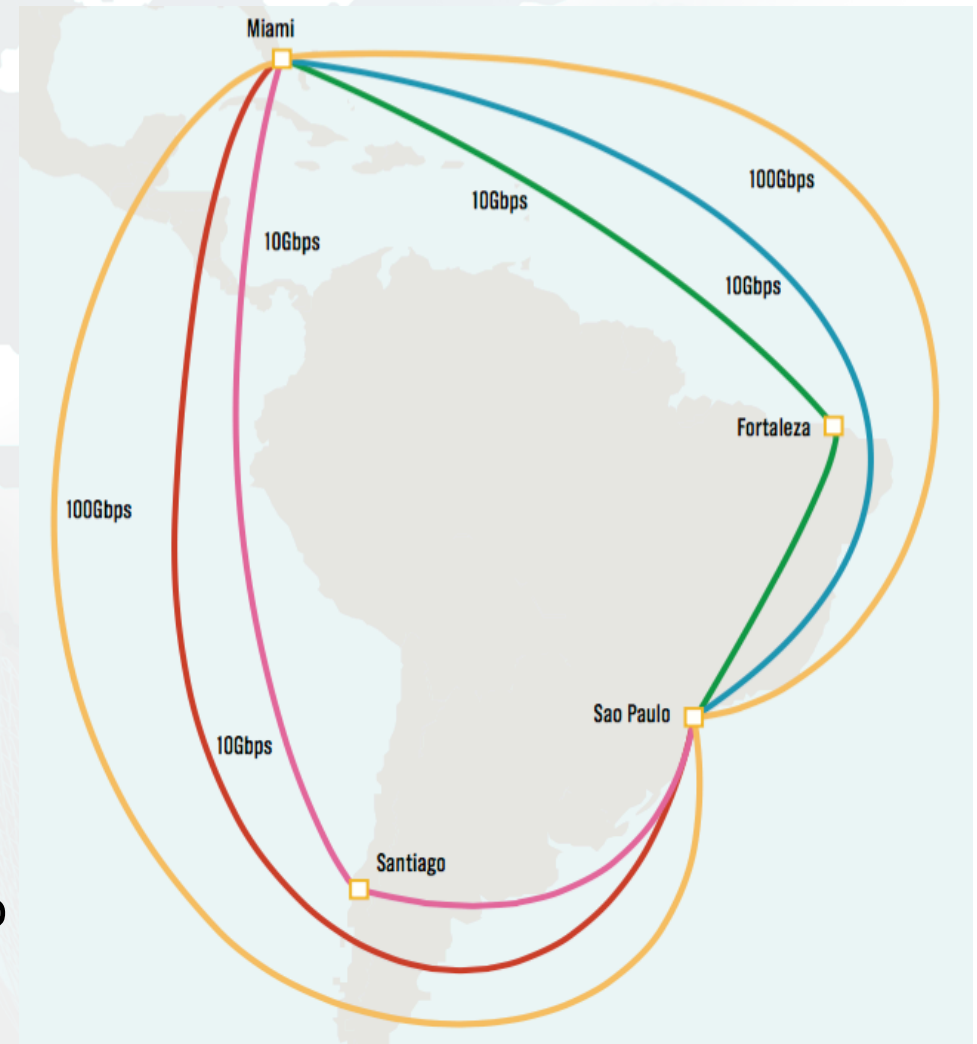
AmLight-ExP Future

- ## AmLight Express:
  - 300GHz of spectrum: Santiago-São Paulo, and São Paulo-Miami
  - Spectrum to be configurable by RENs to meet user/application requirements

- ## AmLight Protect:
  - 100G leased capacity ring
  - Miami, São Paulo, Santiago, Panama City, Miami
  - AMPATH, Southern Light, REUNA, and RedCLARA operated

680G+ bandwidth capacity
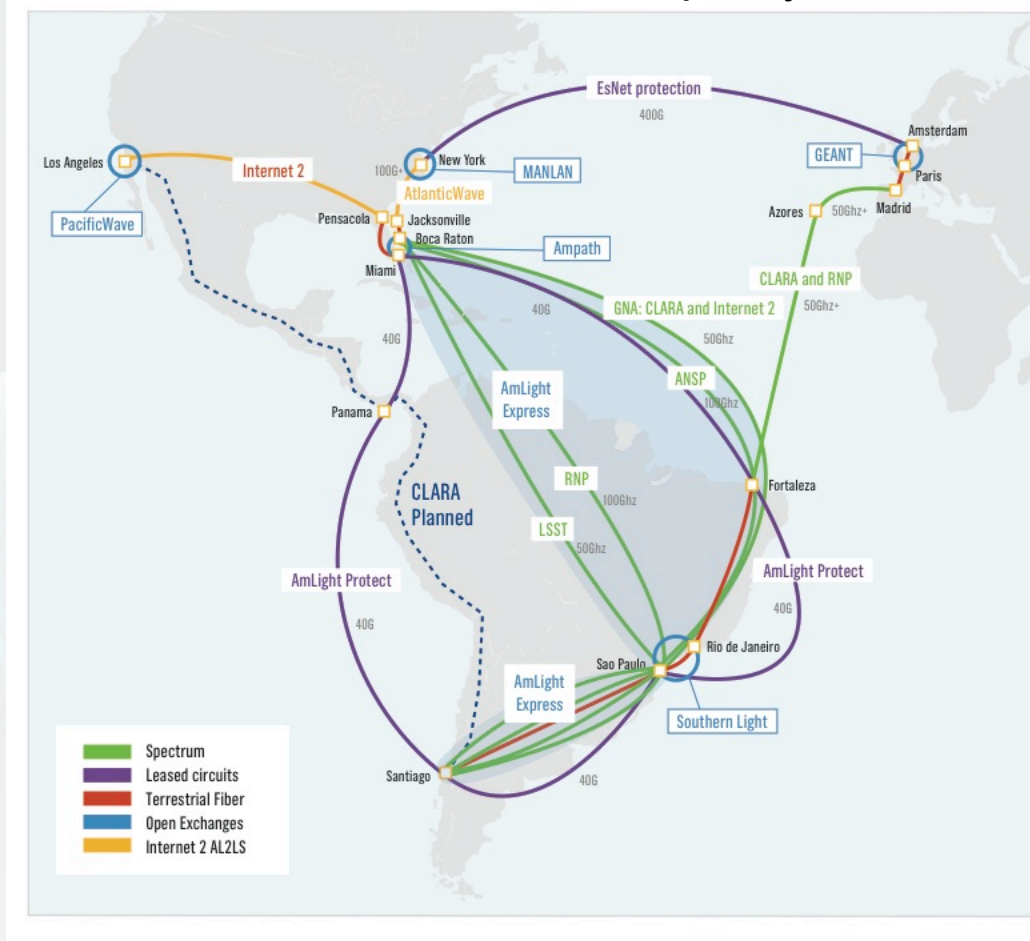
Monet submarine cable

- Monet will provide spectrum for AmLight

- Monet landed in Boca Raton in October 2016

- Shore landings were completed earlier this year in Fortaleza and Praia Grande, Brazil

- Access to spectrum planned for 12/2017

MONET CABLE SYSTEM

ATLANTIC OCEAN

BOCA RATON

FORTALEZA

BU1

BRAZIL

SANTOS

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Super Computing 2016

- AmLight 100G links transported 176Gbps of aggregate traffic between São Paulo, Miami and Salt Lake City
- Each link achieved ~85Gbps, with peaks of 97Gbps
- Experiments with data-intensive flows were organized by the São Paulo Research and Analysis Center (SPRACE)/UNESP, and Caltech
- High-performance servers in São Paulo, Miami and Salt Lake City generated traffic flows
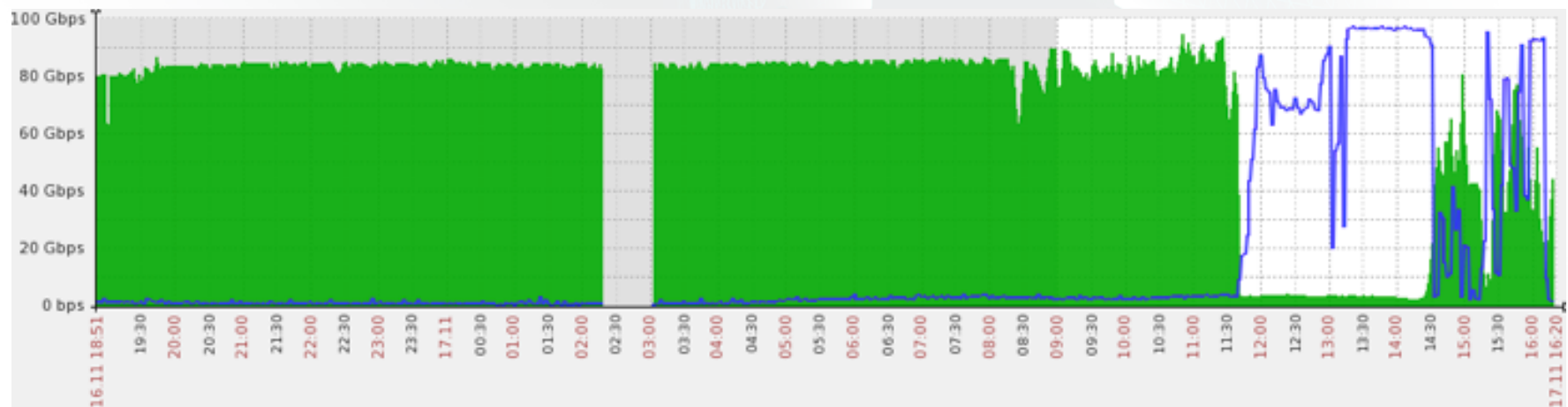
Network Virtualization and SDN Applications

- AmLight became an SDN network in 2014

- Researchers are using slicing to prototype network-aware applications
  - implementing testbeds with real network devices
  - validating their research in a production environment, and at scale.

- Slicing isolates production traffic from experimental network testbeds
  - FSFW acts as a proxy between the physical layer (represented by OpenFlow devices and links) and the control layer, represented by SDN applications
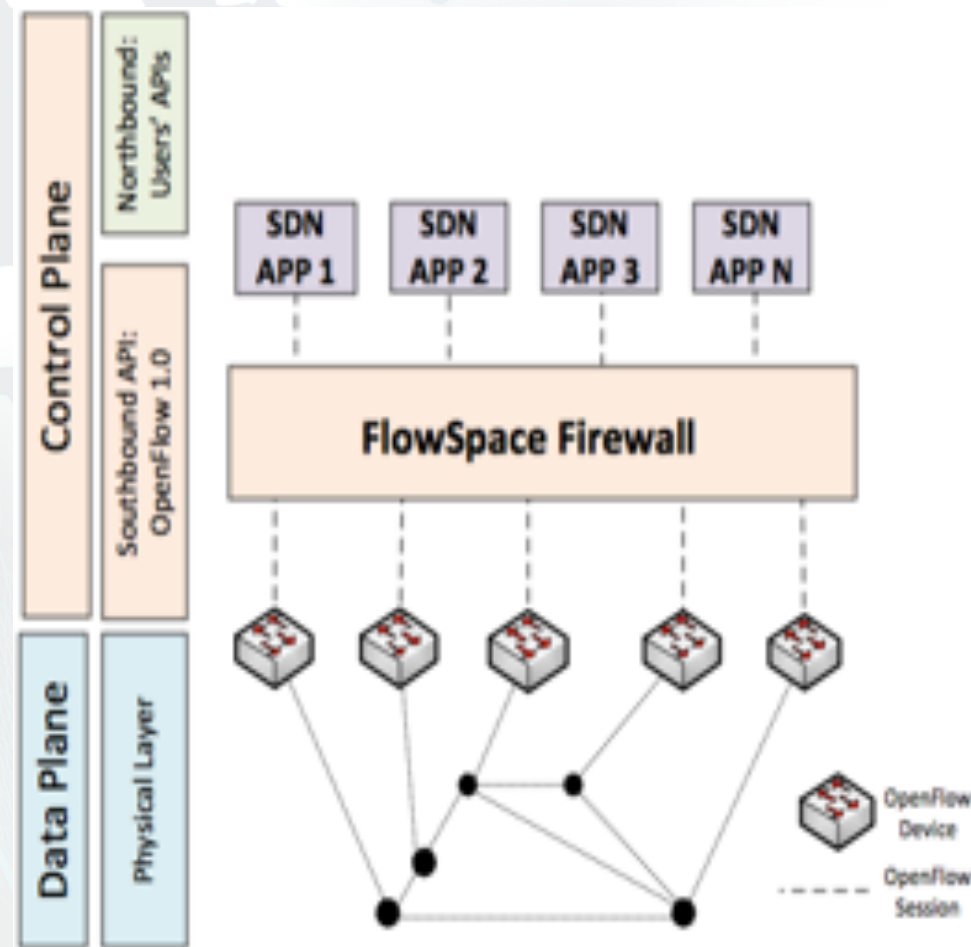
Experimental Testbeds on AmLight-ExP

- 5 SDN-based testbeds hosted at AmLight-ExP in parallel with production applications:
  - Network Services Interface (NSI) testbed
    - Tests software for NSI protocol
  - OpenFlow Statistics Validation testbed
    - Collaboration with Twente University, Netherlands
  - FIBRE testbed
    - Added AMPATH to FIBRE testbed in Brazil
    - Collaboration with RNP
  - OpenFlow/SDN Controllers testbed
    - Tests new controllers and applications
  - ONOS testbed
    - Handles BGP feeds, IP and IPv6 forwarding without IP routers
    - AmLight hosts ONOS is a production network environment

Conclusion

- AmLight-ExP is
  - Implementing an infrastructure that interconnects North America to key aggregation points in South and Central America (Brazil, Chile, Panama)
  - Evolving into a reliable, flexible and efficient research and education network infrastructure
  - Facilitating at-scale experimentation through the implementation of SDN testbeds
  - Meeting the requirements of science applications