



Introduction to USA-South America Software Defined Research & Education Networks



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Who we are?

Florida International University (FIU):

- [FIU](#) is Miami's first and only public research university (55,000 students)

Center for Internet Augmented Research and Assessment (CIARA):

- [CIARA](#) is a research center at FIU positioned to leverage advanced Cyberinfrastructure for science research and education

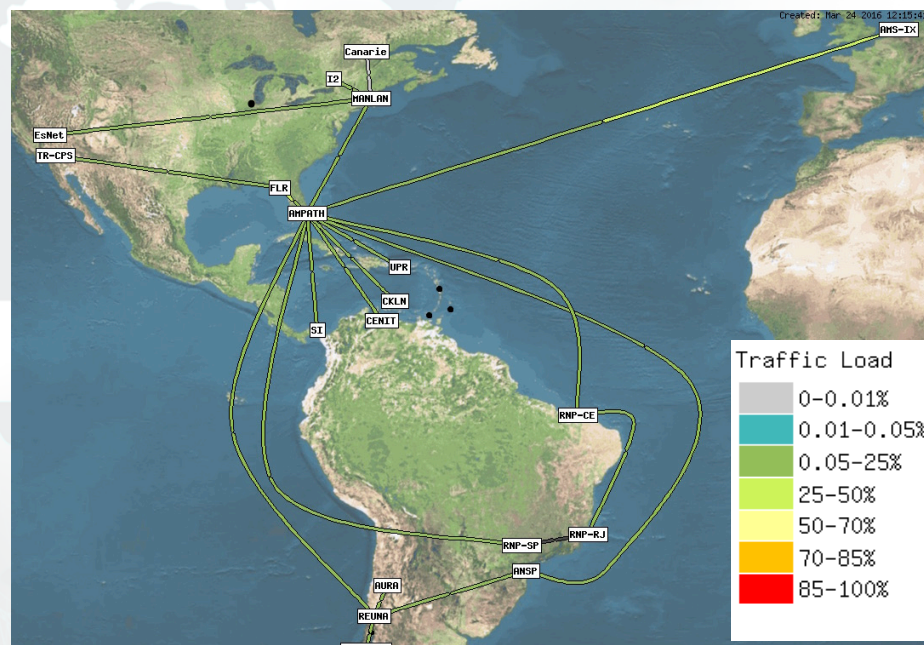


Facilities: AMPATH

AMPATH International eXchange Point:

- AMPATH is an Open R&E eXchange Point (RXP) led by Florida International University ([FIU](http://www.fiu.edu))
- Serves as the premiere interconnection point for network-enabled U.S.- Latin America and Caribbean science research and education.
- Supports science research and education programs of the NSF
- Operates 100G and multiple 10G circuits in collaboration with FLR, ANSP and RNP

www.ampath.net

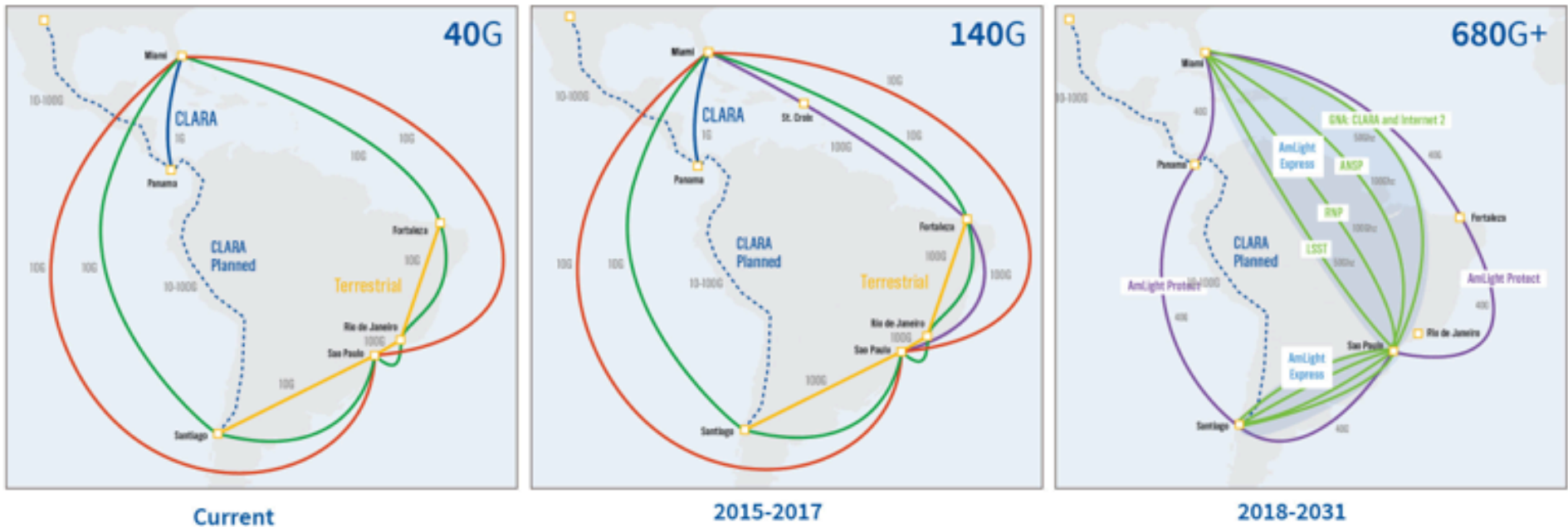


<http://measurements2.ampath.net/>



Facilities: AmLight

Backbone: AMLIGHT: Current to 2031



NSF support for [AmLight](#) Express & Protect is part of a scalable rational architecture, designed to support the needs of the U.S.-Western Hemisphere research and education community that supports the evolving nature of discovery and scholarship.

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Research Interests: Experimental Testbeds

- Understanding and managing risks of running experimental testbeds in a production network environment
 - Experimental testbeds increase complexity of operation and troubleshooting
 - AmLight is a production R&E network infrastructure
 - Network testbeds are broadly supported
 - Researchers are encouraged to use AmLight for prototyping applications

Research Interests: Software Defined Exchanges

- Scientific workflows increasingly require
 - Information about network resources, and
 - Control to react to network conditions efficiently
- The end-to-end path for scientific workflows typically traverses multiple network domains, which
 - interconnect at exchange points
- Software Defined Exchanges (SDX) are an approach to
 - Expose network control capabilities to scientific workflows that span multiple network domains
 - Provide users with an end-to-end service that supports applications' dynamic requirements across multiple network domains

Experimental testbeds on AmLight

Virtualization at AmLight:

- OpenFlow agents on OpenFlow devices connect to the Virtualization Layer (Flow Space Firewall)
- Virtualization Layer controls which <switch,port,vlan> SDN App has access
- SDN Apps send OpenFlow <match,action> to control network forwarding
- SDN Apps might expose APIs for other apps

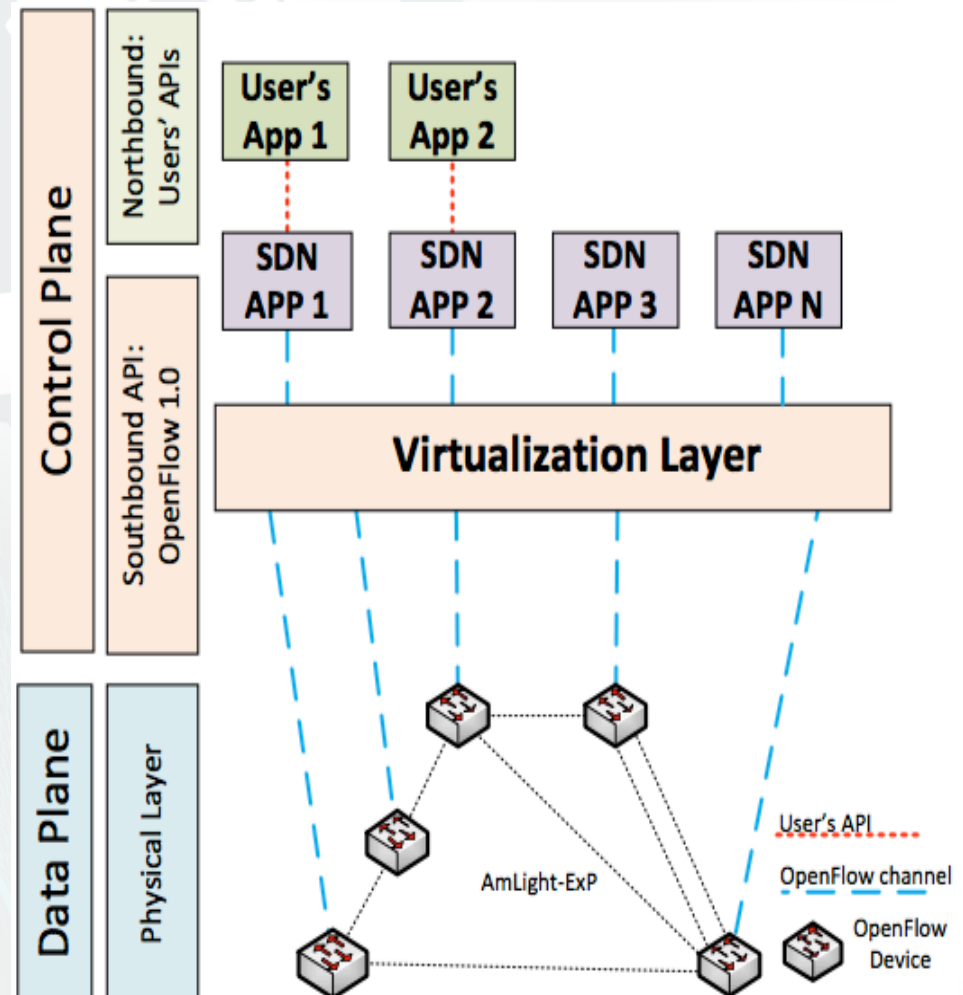
A few testbeds in place at the moment:

- Network Service Interface (NSI) experimentation
- On.Lab ONOS/SDN-IP
- Brazil-Europe FIBRE testbed

Two production virtual networks being used:

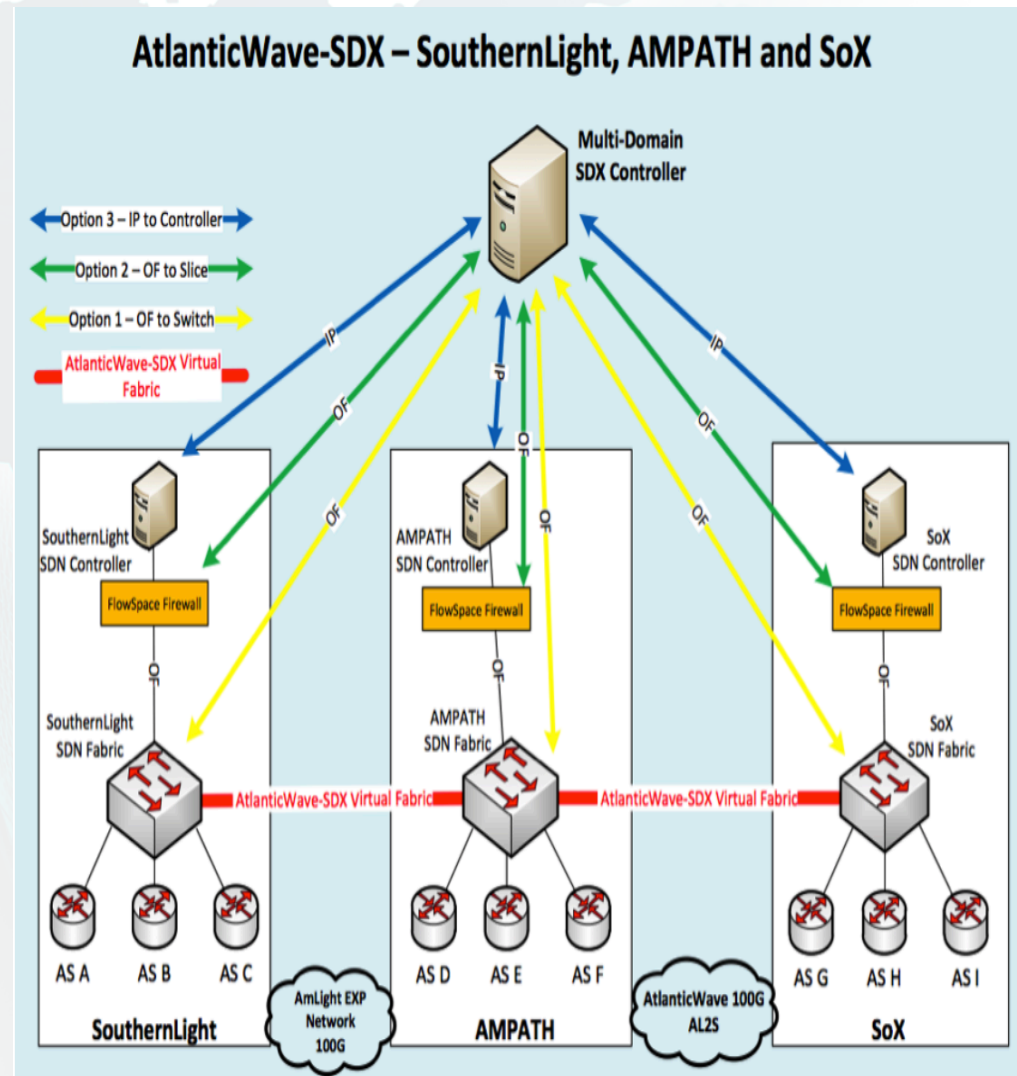
- Internet2's OESS for L2VPNs
- ONOS/SDN-IP for IP forwarding

All production OpenFlow devices (in USA, Brazil and Chile) are available for testbeds



AtlanticWave-SDX

- A Multi-Domain SDX Controller will be developed to manage all RXP (SouthernLight, AMPATH and SoX)
- The Multi-Domain SDX Controller has three possible interfaces to connect to the virtual networks:
 - Option 1: Via OpenFlow directly to each RXP's devices (easy, flexible but unsafe)
 - Option 2: Via OpenFlow to each RXP's network virtualization system (safe but increases operation complexity)
 - Option 3: Via IP+REST interface to each RXP's network controller (safest, but complex to deploy)
- Option 2 seems to most viable for production environments
 - Each RXP will have to provide a virtual network to the Multi-Domain SDX Controller
- The Multi-Domain SDX Controller will provide interfaces for participants to program their networks





Thank You!
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