




# SDN @ AmLight: Benefits, Challenges & Future

**CUDI 2015 – Reunión de Primavera**

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Puerto Vallarta, Mexico

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# Outline

1. Who are we?
2. How is SDN deployed at AmLight?
3. What are the benefits identified for your institution?
4. What were the barriers found in the use of SDN in your institution?
5. Future

# Who we are

AMPATH:

- GLIF GOLE and Academic IXP in Miami
- Interconnects almost all Latin America RENs to other NRENs in the world

SouthernLight:

- GLIF GOLE and Academic IXP in Sao Paulo
- Interconnects all Brazilian RENs and RedCLARA to AmLight

AmLight:

- A set of trans-continental high-bandwidth links connecting SounthernLight, REUNA and AURA/Chile to AMPATH

Partners: Florida International University/FIU, NSF, ANSP, RNP, RedCLARA, REUNA and AURA

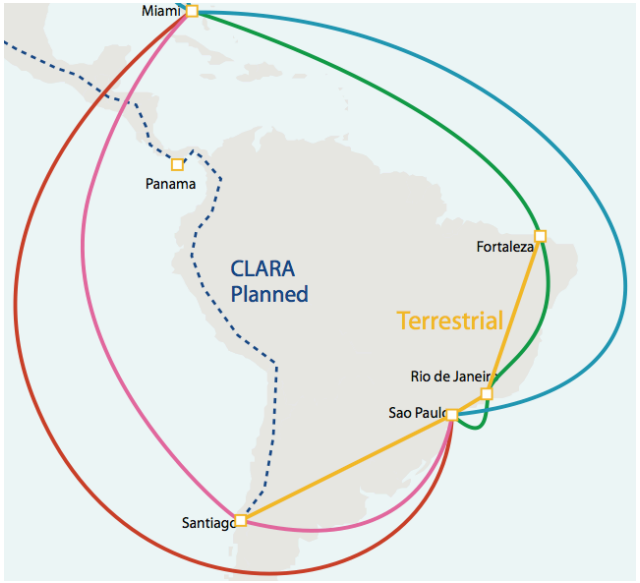
# Who we are (2)

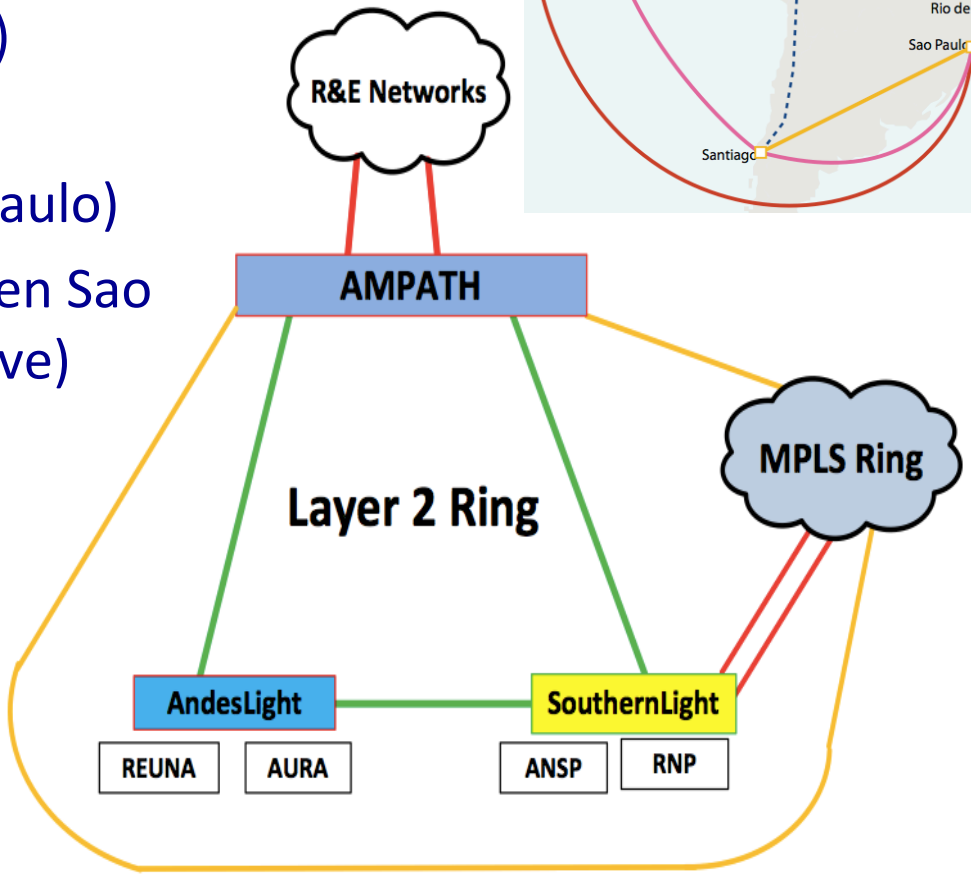
A set of 4 x 10G links connecting South America to AMPATH

- Academic Layer 2 Ring
  (Miami-Sao Paulo-Santiago)
- MPLS Ring
  (Miami-Fortaleza-Rio-Sao Paulo)
- July 2015: 100G link between Sao Paulo and Miami (OpenWave)

Connections:

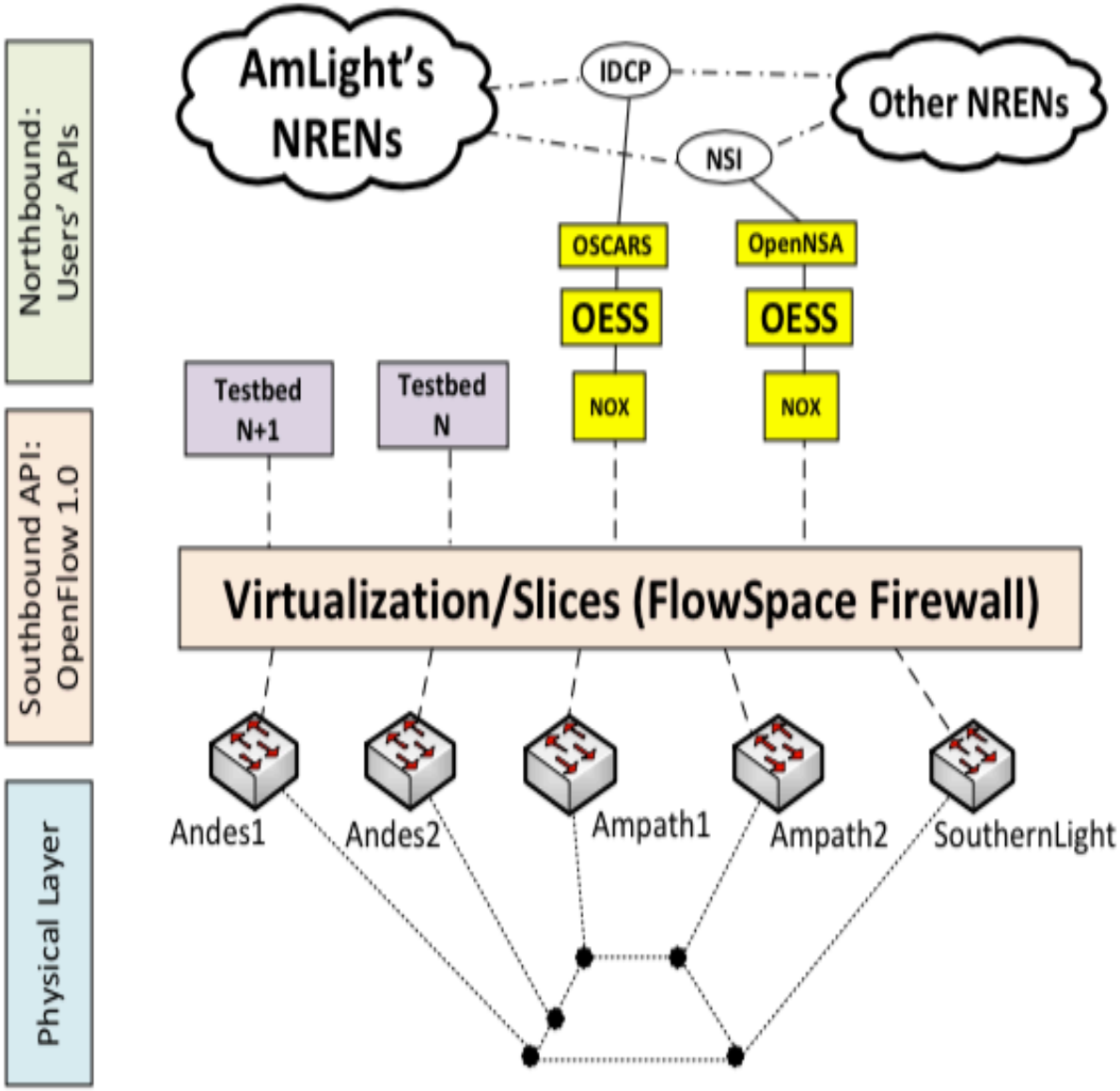
- 13 RENs
- > 1000 Universities and Research Centers



# How is SDN deployed at AmLight?

- *Devices:*
  - *Brocade MLXe*
  - *Brocade XMR*
  - *Brocade CES*
    - *Version 5.6d*
- *Network Virtualization:*
  - *Internet2's FlowSpace Firewall*
- *SDN Orchestrator:*
  - *Internet2's OESS*
- *Final Approach:*
  - *Openflow 1.0*
  - *Controllers installed in Miami*
  - *OSCARS and NSI support*
  - *Non-Academic traffic remains "legacy/protected"*



# What are the benefits identified for AmLight?

*Before the SDN deployment:*

Complex provisioning process:

- Some circuits involve up to seven different networks
  - High level of coordination required with diverse network teams
- Multiple technologies involved
  - From Layer 1 to MPLS
- Some circuits took weeks or even months to be provisioned

Network Programmability:

- The lack of support for network programmability compromises network-aware demos and applications
- Researchers could only view the network status (SNMP)

# What are the benefits identified for AmLight? (2)

## A. Improving operations efficiency

| | Average time to provision a new circuit | | Avg. number of e-mails exchanged | |
|---|---|---|---|---|
| ***Domains involved in the path*** | ***before SDN*** | ***after SDN*** | ***before SDN*** | ***after SDN*** |
| RNP, ANSP, RedCLARA, AmLight, Internet2, ESnet | 5 days | < 5 minutes | 10 | 0 |
| Other domains using OSCARS or NSI support | 12 days | < 5 minutes | 65 | 0 |
| Other domains not using OSCARS or NSI support, < 3 networks in the path | 5 days | * | 10 | * |
| Other domains not using OSCARS or NSI support, >3 networks in the path | 12 days | * | 65 | * |
| With domains in other continents not using OSCARS or NSI support | 45 days | * | 100 | * |

# What are the benefits identified for AmLight? (3)

## B. Introducing network programmability

| | Network Access and Programmability | |
|---|---|---|
| | Before SDN | After SDN |
| Network View | SNMP | SNMP and Openflow |
| Provisioning Defined by the User | - | Full Openflow access through a dedicated slice |
| Multipath experiments | Static paths offered | |
| Flow controlled hop-by-hop | - | |

*Network programmability is the main achievement of this project:*

- *Network-aware applications will have AmLight as a real platform for innovation*

# What were the barriers found in the use of SDN?

- Some legacy protocols and old switching line cards could increase the complexity
  - LACP, Counters, Ethertypes
- Lack of the Hybrid port feature can derail the SDN deployment
- Out-of-band/Control Plane network could be challenging
- “Having a testing environment with the same devices is mandatory”
- Convergence methodology has to be improved
  - Specially in long-haul links

# Future

- Migrate to Openflow 1.3
- Add new applications
  - QoS support
  - IP routing/SDN-IP
- Create a SDX – Software-defined Exchange

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