



# AmLight SDN: Updates since last year

**CLARA-TEC Meeting**

**July 9 2015**

**Vinã Del Mar, Chile**

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# Who we are



## AMPATH:

- Academic IXP in Miami
- Interconnects all Latin America RENS to other RENS in the world

## SouthernLight:

- Academic IXP in Sao Paulo
- Interconnects all Brazilian RENS and RedCLARA

## AmLight:

- Academic network that connects SouthernLight to AMPATH and other RENS in the world

Partners: FIU, NSF, ANSP, RNP, RedCLARA, REUNA and AURA

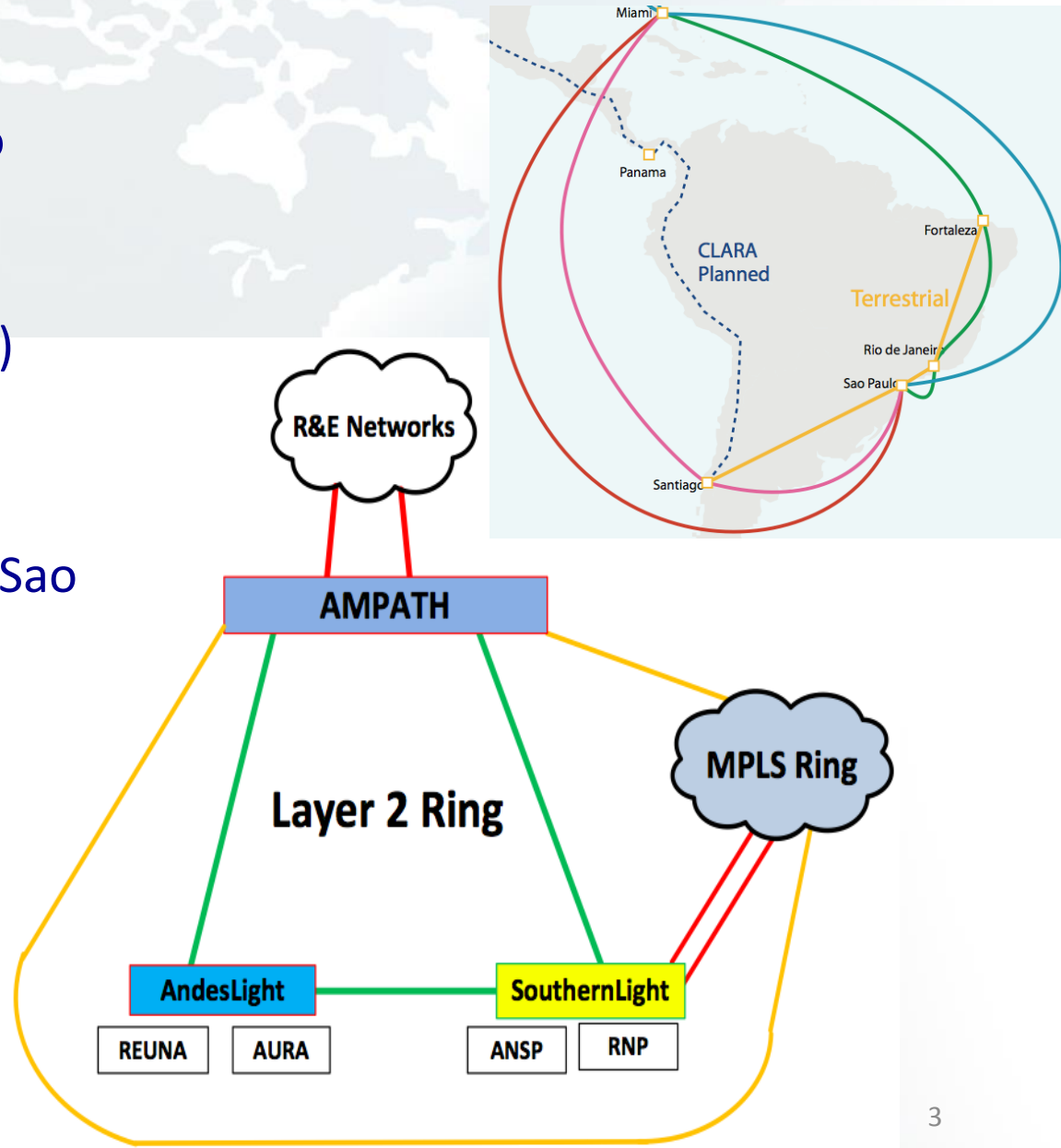
# AmLight Today

A set of 4 x 10G links with two topologies:

- SDN Ring  
(Miami-Sao Paulo-Santiago)
- MPLS Ring  
(Miami-Brazil-Miami)
- Sep 1st: 100G link between Sao Paulo and Miami
- Mutual Redundancy

Connections:

- 13 RENs
- > 1200 Universities and Research Centers



# AmLight Before SDN

- Configuration based on **static** VLANs
- Multiple instances of per-VLAN **RSTP**
- Mutual redundancy created wth:
  - IEEE 802.1ad (**QinQ**) + L2VPNs
- AmLight has achieved 100% availability in 2013, assuming that at least one 10G link was available.

# Why has AmLight moved towards SDN?

*Key motivations:*

***Improving operations efficiency***

***Introducing network programmability***

## Motivation 01: *Improving Operations Efficiency*

Amount of layer 2 circuits requested and networks involved makes the provisioning a complex 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

# Motivation 02: Introducing Network Programmability

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

# Scenario Deployed (1/2)

## Activated Openflow 1.0 + Hybrid Ports

### A. Improving operations efficiency:

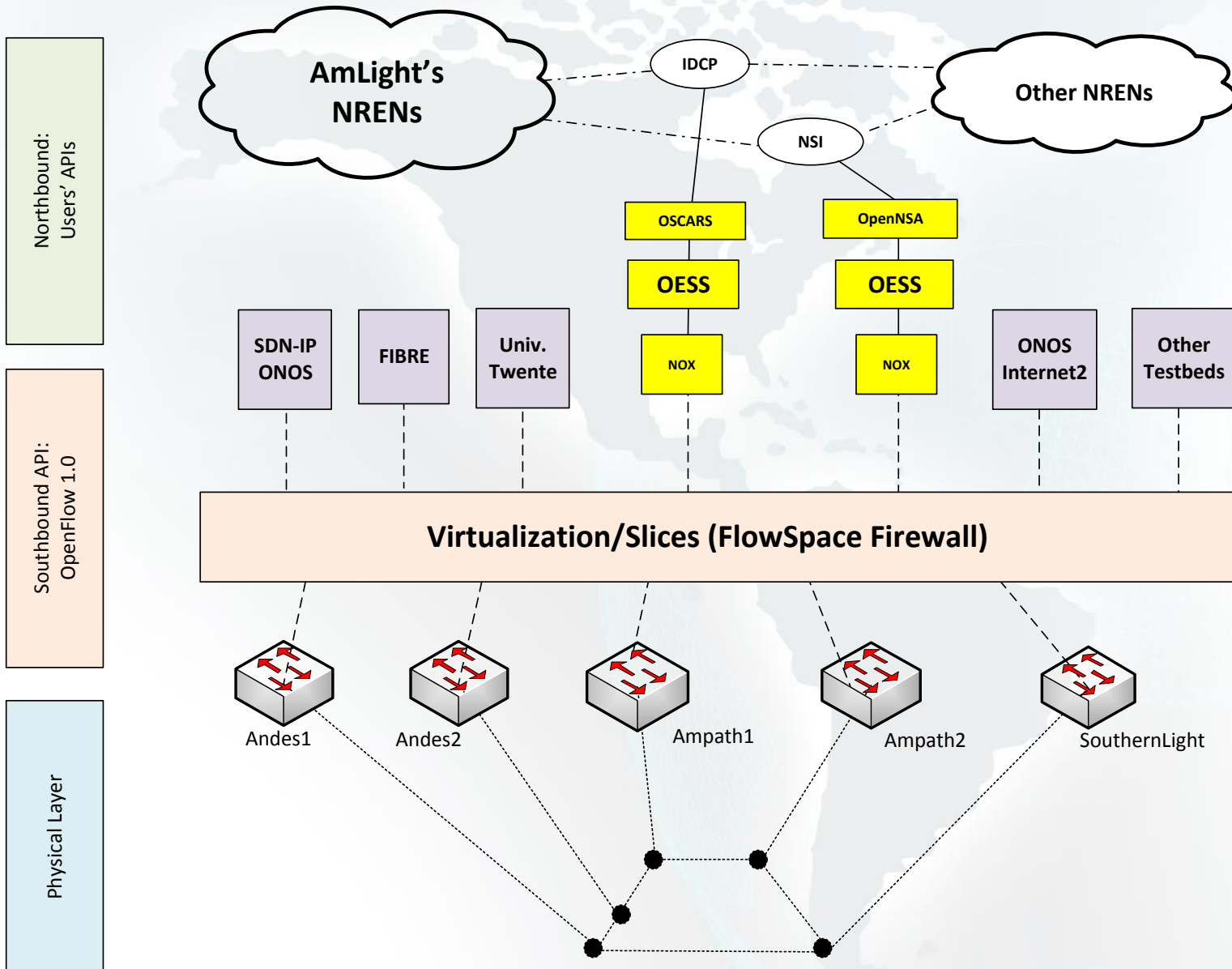
- Internet2's OESS
- OSCARS - IDCP
- OpenNSA - NSI

### B. Introducing network programmability

- Internet2's Flow Space Firewall
  - Network Slice Capability



# Scenario Deployed (2/2)



# Findings (1/2)

## A. Improving operations efficiency

Domains Involved in the path	Average time to provision a new circuit		Avg. number of e-mails exchanged	
	before SDN	with SDN	before SDN	with SDN
RNP, ANSP, RedClara, AmLight, Internet2, ESNET	5 days	< 5 minutes	10	0
Other networks (if IDCP or NSI supported)	12 days	< 5 minutes	65	0
Other networks with NO IDCP or NSI - < 3 networks in the path	5 days	-	10	-
Other networks with NO IDCP or NSI - > 3 networks in the path (Americas)	12 days	-	65	-
Other networks in other continents not using IDCP or NSI	45 days	-	100	-

# Findings (2/2)

## 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*

# Who is using AmLight SDN?

## Current Testbeds (1/2)

- **Interconnecting Testbed's Islands with OpenFlow**
  - In partnership with RNP, a FIBRE testbed island was installed at AMPATH
  - More than ~300 VLANs required between islands (*hard to provision*)
  - AmLight SDN slicing capability in use to interconnect islands natively
- **NSI testing deployment**
  - AmLight uses OpenNSA for NSI inter-domain communication
  - OpenNSA is a software agent of NSI protocol developed by Nordu.Net
  - OpenNSA doesn't support Openflow as backend for network configuration
  - AmLight has developed their own backend to integrate with the SDN network
  - As this code and the NSI protocol are new, a separated slice was created to avoid impact to the production traffic
  - Using the real network but in a dedicated slice with no impact for production

# Who is using AmLight SDN?

## Current Testbeds (2/2)

- **Testing new controllers and applications in a separated slice**
  - New controllers and applications can be easily added for tests (ONOS, Vyatta, etc.)
  - Two orchestrators in place at the same time with no overlapping
- **Demonstrations**
  - Internet2 Multi-Domain Slices (Oct 2014 I2 Tech Exchange Meeting)
    - How multiple slices from different networks could look like one single slice?
    - We showed this was possible and easy to manage
  - Internet2 Inter-Domain IP connections (Apr 2015 I2 Global Summit and ONS 2015)
    - How to interconnect SDN islands using IP?
- **OpenFlow Statistics Validation**
  - PhD study at the University of Twente, The Netherlands
  - OpenFlow Statistics showed bad values coming from some OpenFlow switches
  - A partnership was created to evaluate AmLight switches
  - The work is all being done remotely
  - Fundamental for load-balancing applications in the future (big data applications)

# Future Challenges

- How to scale and support high # of parallel network testbeds?
- How to manage testbeds in a production network?
- While we learning, new testbeds need to be implemented: SDX
- How to migrate network devices between OF versions?

# Future work

- **Testbed Sanitizer** - an OF messages validator
  - Goal: to verify and validate OF equipment capabilities
  - Useful to avoid and to solve problems with 'poor' OF implementations in equipments
- **Migrate to Openflow 1.3**
  - Upgrade equipments and applications
  - Add more resources: match IPv6, QinQ, QoS, Port Group, etc.
- **Deploy applications for QoS and Bandwidth Reservation**
  - Requirement to some Big Data applications



# Thanks!

[www.sdn.amlight.net](http://www.sdn.amlight.net)

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