SDN Testbeds @ AmLight: One Year Later

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Describing AmLight

*AmLight is a Distributed Academic Exchange Point*

4 x 10G links and two topologies:

- **SDN ring:** Miami-Sao Paulo-Chile-Miami
  - 20 Gbps of total capacity
  - Full Openflow and network virtualization support

- **MPLS ring:** Miami-Brazil-Miami
  - 20 Gbps of total capacity
  - Layer 2 support

Soon to be added to the SDN ring:
- A new **10Gbps** ring (capacity)
- A **100 Gbps** alien wave between Sao Paulo and Miami:
  - Focused on experimentation

Total of **120Gbps** to Internet2 through AMPATH IXP
Describing AmLight SDN

- **Production** SDN Infrastructure (since Aug 2014)
- Connects AMPATH and SouthernLight GLIF GOLES
- Carries Academic and Non-Academic traffic
  - L2VPN, IPv4, IPv6, Multicast
- Supports Network Virtualization/Slicing
  - OpenFlow 1.0
  - OESS for L2VPNs
  - NSI (OpenNSA) and OSCARS enabled
- Including AMPATH and SouthernLight
  - Currently 4 slices for experiment (including ONOS SDN-IP)
SDN Stack

AmLight’s NRENs

IDCP

NSI

Other NRENs

OSCARS

OESS

OpenNSA

OESS

ONOS Internet2

Other Testbeds

SDN-IP ONOS

FIBRE

Univ. Twente

NOX

Virtualization/Slices (FlowSpace Firewall)

Andes1

Andes2

Ampath1

Ampath2

SouthernLight

Northbound: Users’ APIs

Southbound API: OpenFlow 1.0

Physical Layer
Programmability @ AmLight

Two possible interfaces to use AmLight:

• **Openflow (1.0, 1.3 in the future)**
  – Through dedicated slices
  – Real devices (Brocade MLXe)
  – Own VLAN range
  – Different virtual topologies available
  – Layer 2 and Layer 3 matches
  – Low level configuration

• **NSI v2 – Network Service Interface**
  – High level abstraction for layer 2 multi-domain provisioning
  – No need to know the topology and physical devices/configurations
Examples – ONOS SDN-IP @ ONS
Examples(2) – ONOS SDN-IP @ ONS

OpenFlow

INTERNET®

GÉANT

Consortium
GARR

OF

OpenFlow

AMLIGHT

AMERICA’S LIGHTPATHS
RESEARCH - EDUCATION
COLLABORATION

FIU

FLORIDA INTERNATIONAL UNIVERSITY
Examples (3) – And more...

- In partnership with RNP:
  - FIBRE (*Future Internet testbeds / experimentation between BRazil and Europe*): how to use an OpenFlow native backbone to interconnect FIBRE islands (or racks)?
  - FIBRE island installed at AMPATH/Miami and using AmLight

- In partnership with Internet2:
  - Internet2 Technology Exchange 2014 – Multi Domain controller managing slices from different SDN domains (Internet2, AmLight, Univ. of Utah and MAX)
  - Internet2 Global Summit – ONOS SDN-IP demonstration

- In partnership with University of Twente:
  - “*Assessing the Quality of Flow Measurements from OpenFlow Devices*”
  - Authors: Luuk Hendriks, Ricardo de O. Schmidt, Ramin Sadre, Jeronimo A. Bezerra, and Aiko Pras

- All of them running on the same production infrastructure
Open Points

Challenges for the near future at AmLight:

• **Troubleshooting**
  – Flow consistence among layers
  – OpenFlow sniffer

• **Quality of Service**
  – Bandwidth Guarantee in an Openflow/SDN
  – Dynamic application load-balance

• **Security**
  – Secure access with network virtualization
  – Isolation between applications
  – *Testbed Sanitizer*

• **Networking**
  – Scalability
  – IP/IPv6/Multicast Routing
  – Inter-SDN domain forwarding (SDX)
What next?

• Do you want to have your own testbed?

1. Send an e-mail to sdn@amlight.net explaining your project
2. Your application will be tested in our Mininet environment
   - Tested for security, not functionality
3. Then, your application will be tested in our physical environment
   - Also for security
   - ... to understand how devices handle your application
4. Once it is ok, your application will be added to our production environment
   - Joint operation
   - Any new code change will restart the process
SwitchOn Workshop – São Paulo/Brazil
October 15th 2015

Do you want to know more?
www.sdn.amlight.net

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