VII Workshop Pesquisa Experimental da Internet do Futuro (WPEIF)

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Moving an IP network to SDN: A global use case deployment experience at AmLight

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Outline

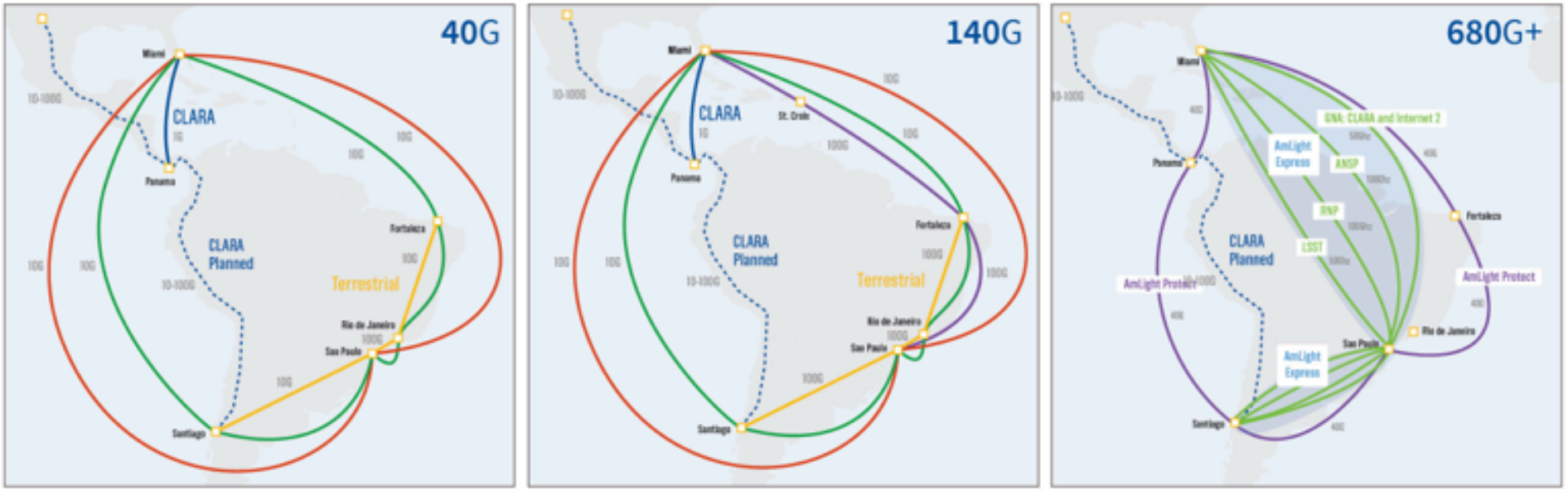
- Context
- Motivation
- Introducing ONOS and the SDN-IP application
- Global ONOS SDN-IP deployment
- ONOS SDN-IP testbed at AmLight

Context: AmLight Today and Future

AmLight is a Distributed Academic Exchange Point

- Responsible to connect Latin America RENs to the U.S.
  - Support research and education activities and foster network innovation

Backbone: AMLIGHT: Current to 2031

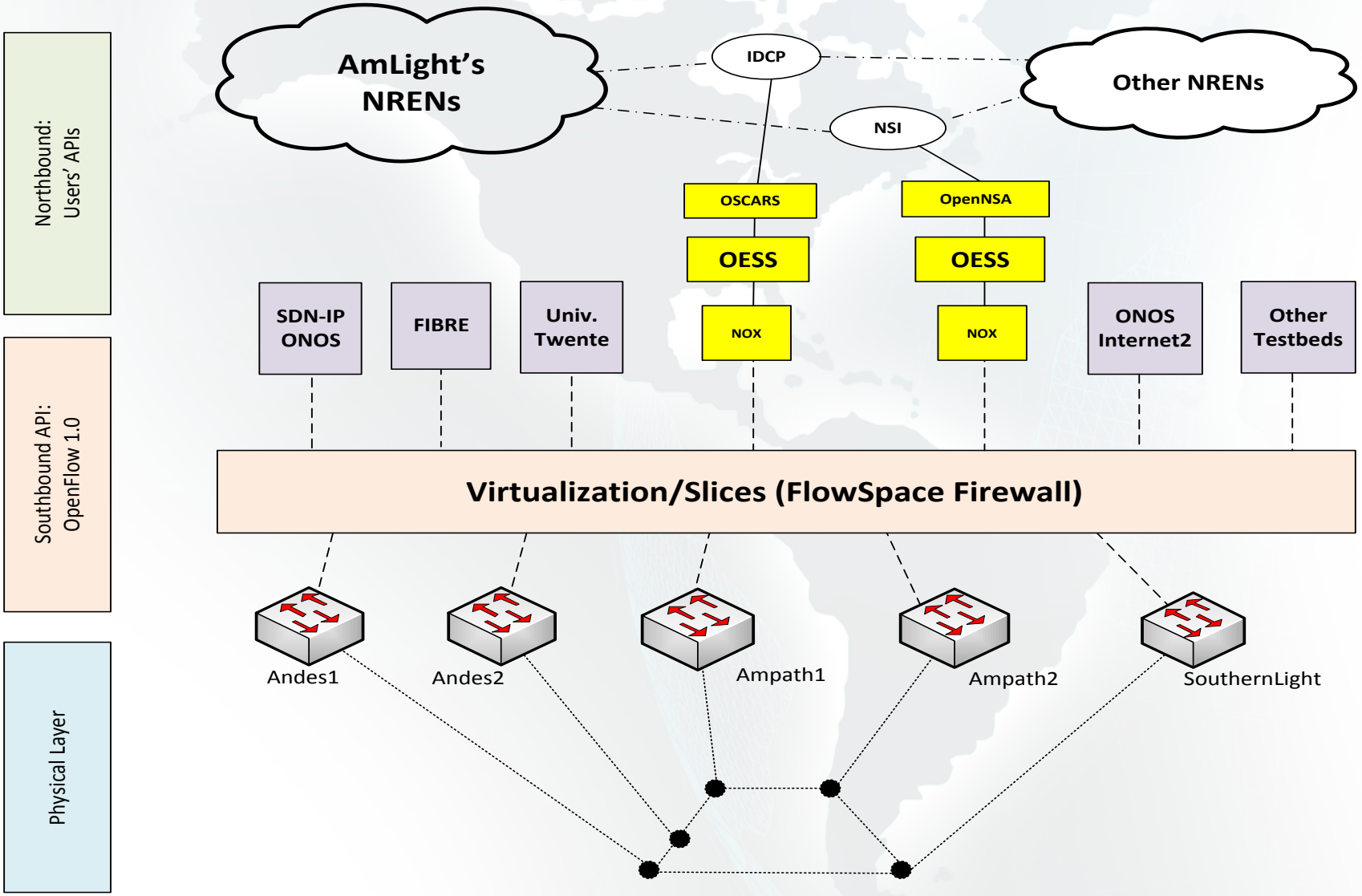


Current 2015-2017 2018-2031

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 scholarships.

NSF Award# ACI-1451018

Context: AmLight SDN



Motivation

- Scenario after migration to SDN/OpenFlow
  - OpenFlow 1.0 up and running
  - Virtualization Layer deployed with Flow Space Firewall
  - Production L2VPN application: Internet2 OESS
    - Both intra and inter domain (OSCARS and NSI) provisioning supported

- But what next?
  - How do we provide more advanced features such as IP traffic routing using OpenFlow?
  - How do we support VPLS and L3VPNs services on top of the SDN/OpenFlow network?

Motivation [2]

- In response to these challenges, AmLight joined Internet2 and GEÁNT in 2015, with the goal of creating a global Layer 3 infrastructure connecting RENs, using Open Source software and SDN/OpenFlow devices.

- Main goals:
  - End-to-end provisioning of Layer 3 connectivity without using legacy routers
  - Transform Autonomous Systems (AS) running OpenFlow into IP/BGP transit networks
  - Provide a feasible migration strategy from legacy IP/BGP networks towards an SDN/OpenFlow approach

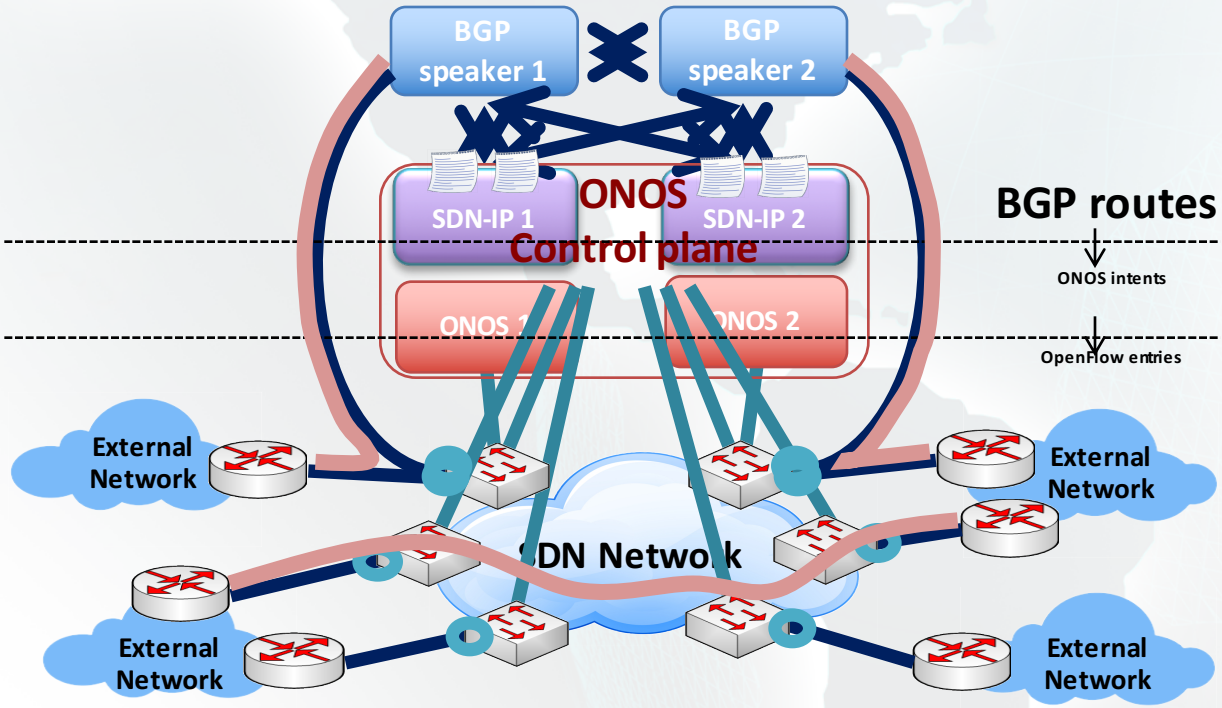
ONOS and the SDN-IP application

- Why ONOS?
  - Free, Open Source, carrier-grade SDN OS designed for Service Providers
  - Well-defined Northbound and Southbound abstractions and software modularity
  - Key Principles:
    - Scalability
    - High Availability
    - Performance

ONOS and the SDN-IP application [2]

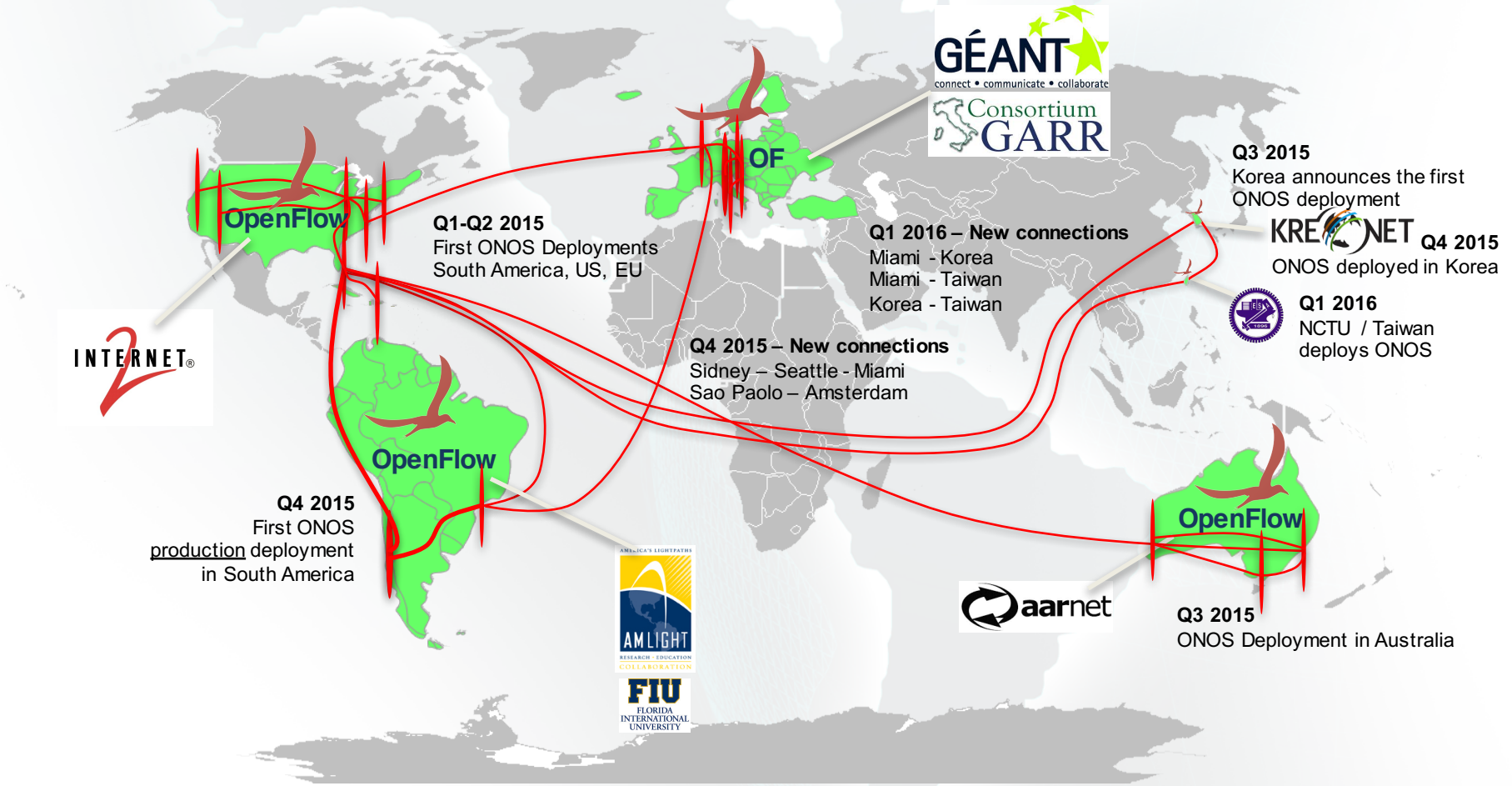
- ONOS SDN-IP
  - It is able to connect an Software-Defined network to external networks by using BGP
  - It provides a migration path to SDN
  - It decreases costs (L3 communication with no core routers)

SDN-IP architecture



Animation source: ONOS SDN-IP Global Deployment Powered by ONOS - On.Lab ONS 2016

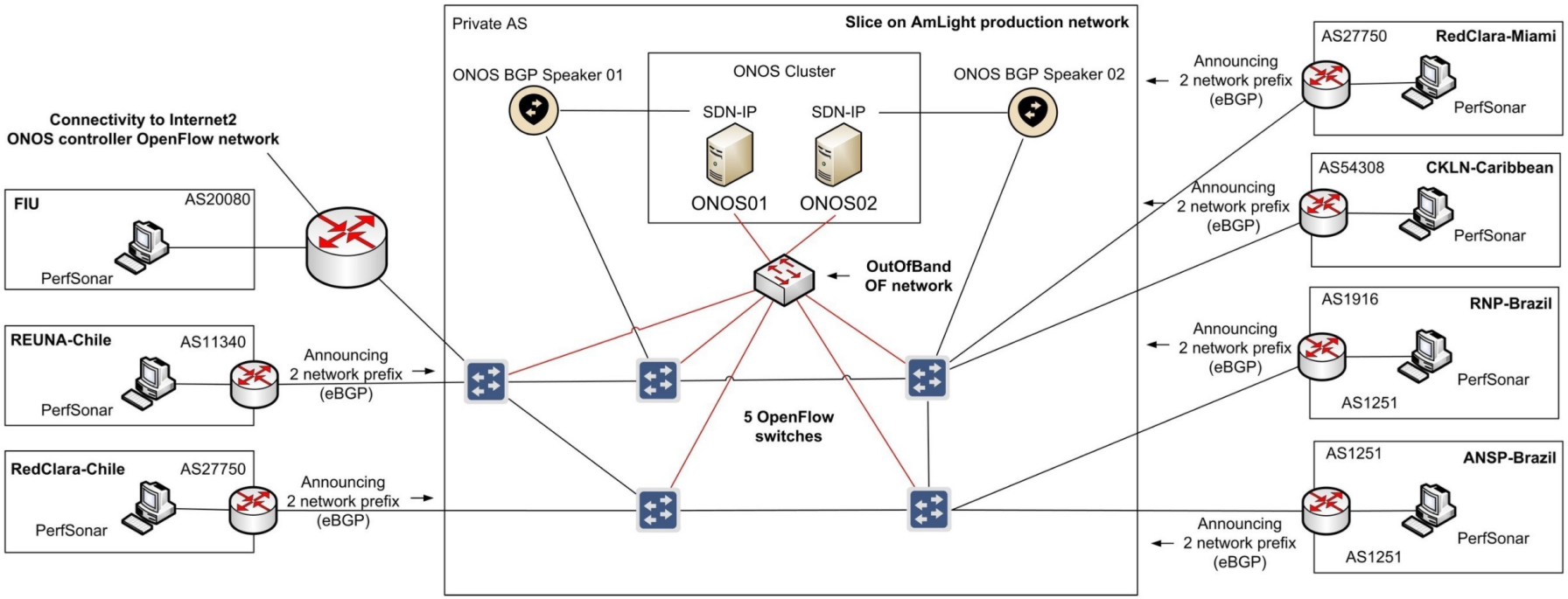
Global SDN deployment powered by ONOS



Animation source: ONOS SDN-IP Global Deployment Powered by ONOS - On.Lab ONS 2016

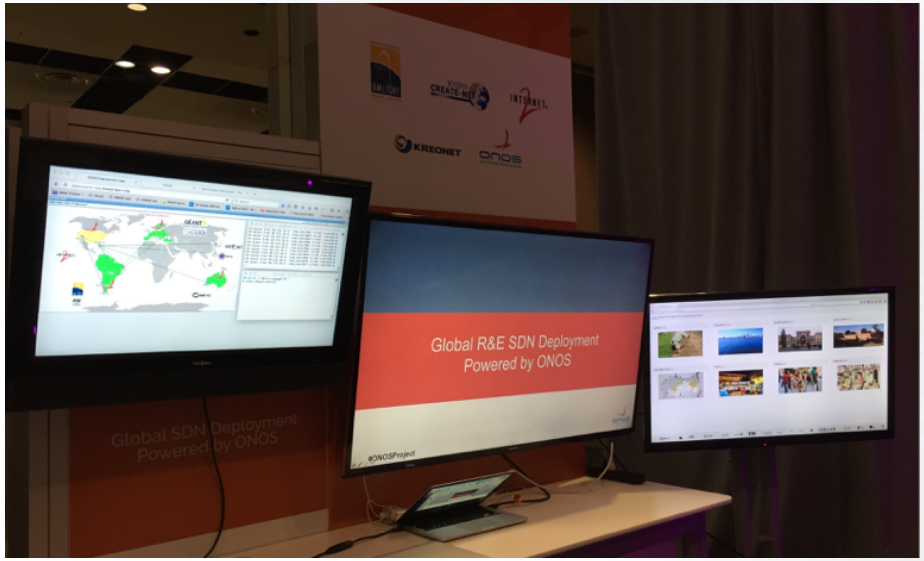
ONOS SDN-IP testbed at AmLight

- Major challenges
  - OpenFlow features support (or lack of support)
  - Testbed sanitizer process: validation of a new testbed



SDN Global Deployment demos

- We demonstrated the ONOS SDN-IP Global testbed at:
  - ONS 2015
  - SIGCOMM 2015
  - ONS 2016



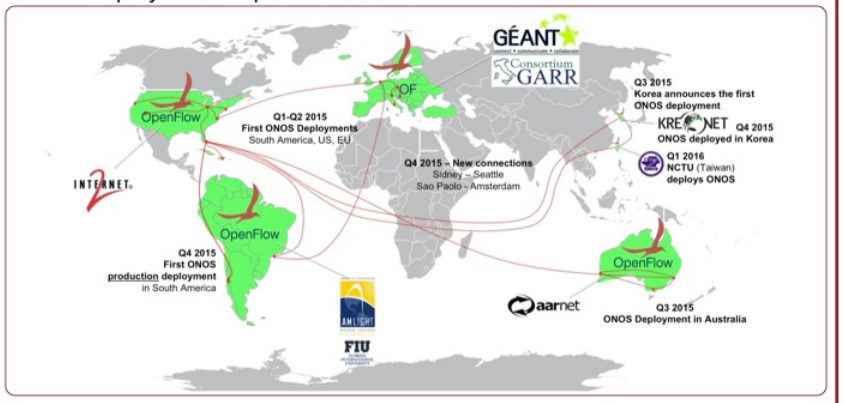
SDN Global Deployment Powered by ONOS

Motivation and Goals

R&E Network Operators and Users
- Create a Global SDN Network
- Provide L2 and L3 connectivity, no "legacy" equipment
- Enable network and services innovation

ONOS Community
- Demonstrate ONOS in real networks
- Test High performances, HA and scalability
- Learn an improve

ONOS Deployment Map and Timeline



Enabling Network Innovation with New Apps

Castor
- *L2/L3 connectivity for SDXs*
- Developed and deployed in AARNET

SDN-IP
- *Transforms a SDN into a transit IP network*
- SDN AS uses *BGP to communicate with neighbors*
- L3 connectivity without legacy routers
- Deployed by AmLight, Internet2, KREONET, NCTU

SDX L2/L3
- *L2/L3 connectivity for SDXs*
- Developed and deployed by GEANT

VPLS
- L2 broadcast overlay networks on demand
- Ready to be deployed on AmLight

Future work

- Bring more R&E network operators online
- Support multi-table pipeline switches
- Focus on stability, performances and scalability

Final Considerations

- Global SDN deployment provided excellent visibility and experience to AmLight
- AmLight's network slicing capability has proved to be a valuable asset for testing new solutions using real network hardware and in a large scale
- ONOS and its SDN-IP application was validated as a non disruptive solution that could be easily used as a migration path from legacy IP/BGP networks towards an SDN approach
- As soon as we move to OF 1.3 we'll test more features with ONOS, such as multi-table pipeline support, QoS and IPv6 routing.
- We have plans to test more advanced features with ONOS, such as the VPLS application.

Acknowledgements

- We'd like to thank ON.Lab team (www.onlab.us), in special Luca Prete, for all support provided for this experimentation.

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Thank you!
Questions?

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