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
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.

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Context: AmLight SDN

AmLight’s NRENs

IDCP

NSI

Other NRENs

OSCARS

OpenNSA

OESS

OESS

SDN-IP ONOS

FIBRE

Univ. Twente

NOX

NOX

ONOS Internet2

Other Testbeds

Virtualization/Slices (FlowSpace Firewall)

Andes1

Andes2

Ampath1

Ampath2

SouthernLight

Northbound: Users’ APIs

Southbound API: OpenFlow 1.0

Physical Layer
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
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
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.
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Questions?

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