Global R&E SDN Deployment
Powered by ONOS
Motivation and Goals

R&E Network Operators and Users

Create a global SDN network

Provide L2 and L3 connectivity without “legacy” equipment in the network core

Enable network and services innovation

ONOS community

Demonstrate ONOS in real networks

Test High performance, HA and scalability in real networks

Learn and improve

Agile collaboration model

R&E Network Operators

ONOS Community

Requirements/Learning/Bug Fixes

ONOS and Use Cases
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- **Q1-Q2 2015**: First ONOS Deployments - South America, US, EU
- **Q1 2015 - New connections**: Miami - Korea, Miami - Taiwan, Korea - Taiwan
- **Q4 2015 - New connections**: Sidney – Seattle - Miami, Sao Paolo – Amsterdam
- **Q4 2015**: First ONOS production deployment in South America
- **Q3 2015**: Korea announces the first ONOS deployment
- **Q1 2016**: NCTU / Taiwan deploys ONOS
- **Q1 2016**: New connections - Miami - Korea, Miami - Taiwan, Korea - Taiwan
- **Q3 2015**: ONOS Deployment in Australia

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How the testbed works?

- **AS #20080**
- **eBGP over L2 dedicated circuits**

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The AmLight use case

- BGP speaker 1
- BGP speaker 2
- SDN-IP 1
- SDN-IP 2
- ONOS 1
- ONOS 2
- BGP routes
- ONOS intents
- OpenFlow entries

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Enabling network innovation with new apps

Castor
• Provides 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 (upgrading), KREONET, NCTU

SDX L2/L3
• Provides L2/L3 connectivity for SDXs
• Developed and deployed by GEANT

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

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ONOS
• OF Multi-table pipelines support
• Intent framework – performance improvements

Hardware
• Lack of carrier grade >=100G hardware for WAN
• OF 1.3 yet not supported (enough), OF 1.0 badly supported
• ONOS seems too fast for the majority of the hardware out there
• Better resources isolations

(Bad) practices / People
• Testing code on the production network
• “I want to deploy SDN, but I don’t let me see any code…”

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Conclusions

Summary
• Over 60 OpenFlow switches, 12 institutions connected across 5 continents
• ONOS applications validated: SDN-IP, SDX-L2/L3, Castor

Insights
• Deployments need to move to OF 1.3 and support for multi-table pipelines
• Change of mentality needed in R&E network operators: software and agile methodologies
• Vendors need to improve OF support and guarantee resources isolation

Future work
• Bring more R&E network operators online – starting Q2 2016
• Support multi-table pipelines in switches
• Support new apps (i.e. packet-optical, network virtualization, VPLS)
• Focus on stability, performances and scalability

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Are you ready to join us?