ONOS and CORD
Summary and Future Plans
Agenda

● Who we are
● What we do: ONOS and CORD
● Deployments
● Future integration
● Conclusions
Who we are
Open Networking Lab (ON.Lab)

“The Open Networking Lab was founded as a 501 (c) (3) non-profit to pursue our vision of what Software Defined Networking could be for the public good.”

Nick McKeown
KP, Mayfield, Sequoia Professor, Stanford

Scott Shenker
Professor, UC Berkeley Chief Scientist, ICSI

Guru Parulkar
Executive Director, ON.Lab, Executive Director ONRC Consulting Professor, Stanford

Larry Peterson
Robert Kahn Professor Princeton (Emeritus)
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<th>ON.LAB</th>
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- Added four service providers and two vendors as partners
- Added 20+ collaborating organizations -- many R&E network operators

Strong Partnership & Community in a year

#ONOSProject
What we do
ONOS for Service Providers

- Scalability, High Availability & Performance
- Northbound & Southbound Abstractions
- Modularity
ONOS Architecture

- CORD
- SDN-IP
- VPLS
- Packet-Optical
- Apps

NB Core API

Distributed Core
(state management, notifications, high-availability & scale-out)

SB Core API

Providers

Protocols

Providers

Protocols

Providers

Protocols

Providers

Protocols

ONOS Architecture

#ONOSProject
Deployments
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

Requirements/Learning/Bug Fixes

R&E Network Operators

ONOS Community

ONOS and Use Cases

#ONOSProject
Global SDN Deployment Powered by ONOS

Q3 2015
Korea announces the first ONOS deployment

Q4 2015
ONOS deployed in Korea

Q1 2016
NCTU / Taiwan deploys ONOS

Q1-Q2 2015
First ONOS Deployments
South America, US, EU

Q1 2016 – 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
ONOS Deployment in Australia

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How the testbed works?

eBGP over L2 dedicated circuits
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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CORD Deployment @ AT&T

- Announced by John Donovan @ ONS2016
- Lots of positive feedback from the first 10 users
- Now moving to 100, 1000 users
Deployments, next steps
What RENs ask for
• A simple solution that works
• Layer 0/1: Lambda allocation / OTN
• Layer 2: Connect multiple end-points
• Layer 3: Internal and International BGP Peering

What SPs ask for
• All above..
• Yang, Netconf support
• Simplify / reduce CAPEX/OPEX in Access and Metro Networks

As always…
• HA, High performances,
• Being “Carrier Grade”
RENs, Action Plan

Orchestrator

- Ability for both Users and Operators to allocate end-to-end resources.
- International peering
- L3 circuits and best-effort

Layer 3

OpenFlow switches

Layer 2

VPLS / SDX-L2

Layer 0 /1

Packet-Optical

Optical circuits in the Core and for Users

Broadcast L2 networks on demand

SDN-IP / SDX-L3 / Castor

(E)-CORD

CORD / ONOS Applications

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Summary

• ONOS and CORD (soon) are out as Free, Open Source Projects

• Over 60 OpenFlow switches, 12 institutions connected across 5 continents
• ONOS applications validated: SDN-IP, SDX-L2/L3, Castor
• CORD Field Trial @ AT&T

Future work

• Bring more R&E network operators online – starting Q2 2016
• Support multi-layer apps (i.e. packet-optical, network virtualization, VPLS)
• More (and bigger) CORD field trials

Thoughts

• Make goals clear
• Keep it simple and concrete
• Please, don’t re-invent the wheel…
• Academia, Research Centers and RENs can provide lots of high quality Man Power