OSN Days Tokyo
October 23, 2018

Heather Kirksey
VP, Ecosystem & Community
Linux Foundation
The Linux Foundation is creating the greatest shared technology investment in history by enabling open source collaboration across companies, developers, and users.
Today the Linux Foundation is much more than Linux

**Security**
We are helping global privacy and security through a program to encrypt the entire internet.

**Networking**
We are creating ecosystems around networking to improve agility in the evolving software-defined datacenter.

**Cloud**
We are creating a portability layer for the cloud, driving de facto standards and developing the orchestration layer for all clouds.

**Automotive**
We are creating the platform for infotainment in the auto industry that can be expanded into instrument clusters and telematics systems.

**Blockchain**
We are creating a permanent, secure distributed ledger that makes it easier to create cost-efficient, decentralized business networks.

**Web**
We are providing the application development framework for next generation web, mobile, serverless, and IoT applications.

We are regularly adding projects; for the most up-to-date listing of all projects visit tlfprojects.org
What is LF’s role in projects?

| Governance and Membership | • Incorporation, Tax status, Bylaws, Member Agreements, Anti-trust, etc.  
|                          | • Ongoing business development and membership recruitment |
| Development Process       | • Technical Decision Making  
|                          | • Project Life Cycle  
|                          | • Release Process |
| Infrastructure            | • Custom infrastructure using open source best practices  
|                          | • Security and reliability |
| Ecosystem Development     | • Marketing  
|                          | • Events  
|                          | • Training |
| IP Management             | • Code Provenance  
|                          | • Trademark management  
|                          | • Legal defense and Collaboration |
Linux Foundation and Networking
Networking is the fabric for Growth & Innovation Across Industries

Automotive
Connected Cars
Connected cars market projected to reach USD $219.21 billion by 2025*

Retail
Connected Stores
82% of smartphone user say they consult their phones for in-store purchases***

Energy
Connected Homes
Global Smart Home Market to Exceed $53.45 Billion by 2022**

Agriculture
Connected Cows
Global Connected Cow and Farm Market Set to Exceed $10 Billion in 2021****

Networking
Carrier, Cloud, Enterprise

Data Sources: *ResearchAndMarkets.com  **Zion Market Research  ***Salesforce: Connected Shopper Report  ****Arcluster
Linux Foundation Leads Modern Networking Innovation

- 21 Open Source Networking Projects
- 10/10 Networking Vendors Active
- $576 M Shared Innovation
- 9/10 Most Important Projects
- ~70% Global Subscribers Represented
- 15 Minute New Service Creation
Revolution in the Networking Ecosystem

Proprietary
Vertically integrated, vendor-centric solutions to mix & match options at every level

Collaborative Design & Development
- Vendors and users – instant feedback
- Rapid, unified standards implementation
- Shared development of basic capabilities - supply chain efficiency

New Strategic Vendor Profile
- Broad, open portfolio
- Focus on ecosystem interop - reduce integration time and risk
- Strong implementation services & support
Why Open Source Networking?

› Choose each element of your networking stack, with assured interoperability

› Improve efficiency & quality for development & implementation, reduce risk & cost

› Deliver exactly the network services you need, as you need them

Source: ACG report: The Impact of Open Source Technologies on the Communication Service Provider Vendor Ecosystem
Leading Surveys on Open Source & Networking

Motivators of Open Networking
End User Driven Innovation

All Layers of Open Network
Core to CPE, Edge & Access next

Report for Heavy Reading 2018 Open Networking Ecosystem Survey
Open Source Networking / SDO Landscape

AUTOMATION OF NETWORK INFRASTRUCTURE FOR CLOUD + APPS + IOT

- SONiC
- CLOUD NATIVE COMPUTING FOUNDATION
- OPEN SECURITY CONTROLLER
- CORD
- ARIA

- Akailo Edge Stack
- ONAP
- Open Source MANO
- OpenStack

- OPEN DAYLIGHT
- Tungsten Fabric

- OPNFV
- DANOS
- FreerangeRouting
- P4
- OpenSwitch
- Stratum
- SONiC

- CI/CD
- TELECOM INFRA PROJECT

THE LINUX FOUNDATION
Open Source Data Plane and NOS Projects
Rapid feature iteration independent of hardware lifecycle

What
Innovative features that may not exist in commercial offerings.

Why
NFV options enable near-instant delivery of new network services.

How Consume
May be OEM’d in commercial offerings, or implemented in white box environments.
Open Source Control Plane Projects
The backbone of modern network management

What
Execute the detailed network requirements of larger orchestration and automation frameworks (ONAP, OpenStack, CORD).

Why
Assume multi-vendor, mixed P/V environments.

How Consume
Range of open source and/or packaged distribution options.

[Logos for OpenDaylight, Tungsten Fabric, ONOS]
Management Plane, Monitoring and Analytics Projects
Translate business layer intent to network - ensure healthy operations

What
Capture large amounts of real-time data, cut down weeks/months of big data stack integration effort for network analytics to just 1 hour.

Why
Cloud & carrier focus on network automation = doubling of investment in orchestration layer in the next 5 years.

How Consume
Multi-team design, implementation efforts
Open source platforms + custom development + integration services.
Introducing LF Networking (LFN)
LF Networking (LFN) brings together seven top networking projects to increase harmonization across platforms, communities, and ecosystems.
LF Networking Governance

LFN Governing Board

- Board Committees
- End User Advisory Group
- Compliance & Verification

Technical Advisory Council (TAC)

- ODL TSC
- OPNFV TSC
- ONAP TSC
- FD.io TSC
- Etc...

Developer Communities

Cross-project collaboration
Converged Infra
New Project Induction
Developer Voice to GB

Marketing Advisory Council

- ONAP WG
- FD.io WG
- OPNFV WG
- ODL WG
- China PR WG
- Etc...

Annual Marketing Plan
PR
Events
Content/Web
Branding
Market Development

Budget
Strategy
Marketing Strategy
Legal

End User Advisory Group
Compliance & Verification

THE LINUX FOUNDATION
Projects crossing boundaries to interoperate and create more value
Recent News
LFN Project Initiatives & Milestones Further Enhance Cross-Stack Integration

• Compliance & Verification Program Expansion
• OSN Days
• OPNFV & ETSI: Joint Plugfest/Plugtest
• New ONAP PoC: Cross-Domain & Cross-Layer VPN
• Tungsten Fabric Carbide and 5.0.1
• FD.io 18.07
• OpenDaylight Fluorine
Continuum of VNF Compliance Testing

- VNF Packaging
- Lifecycle/Onboarding Tests
- Functional Tests
- Other (performance/security/etc.)

2H18 Focus
# OVP- VNF Compliance Program Launch Timeline

<table>
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<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
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<td>Stable Draft</td>
<td>TSC Reviews</td>
<td>Community Approval</td>
<td>GB Vote</td>
<td>Workflow tooling</td>
<td>Website planning</td>
<td>Finalize Branding</td>
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<tr>
<td>M4 Code Freeze</td>
<td>OPNFV Gambia</td>
<td>ONAP Casablanca</td>
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**Program Definition**
- Approve Program Governance
- Finalize 3rd Party Lab Governance
- ONAP Test Case Development
- VNFSDK Refactoring Work
- Start documentation work

**Technical Enhancements**
- Beta testing ONAP VNFs
- Dovetail Integration

**Go to Market**
- Vendor Outreach/Initial cohort recruitment
- (Re)branding and website
- Finalize Terms & Conditions
ONS EU: ONAP CCVPN Cross Layer VPN Service Demo

Visit CCVPN at LFN Demo Booth #6 for more details.
VCO Demo – ONS EU 2018

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Cross-Community Open Source Collaboration
Ecosystem Partners
What is VCO?

- Cloud Native approach to deploying NFV closest to subscriber
- One of the Edge Blueprints as discussed in the community
- Based on OpenStack and Kubernetes
- Massive Scale => Large Number of sites
Telco CO - Traditional Status

- Closed, Rigid and Complex
- Variety of Access & Speeds
- Wide variety of hardware – routers, switches, gateways, servers etc
- Lack of standard interfaces => lack of programmability

Telco COs -- Modernization

- Virtualization
- Reduction in CAPEX and OPEX by >30%
- Open and Flexible & Standardized
- Software Defined
  - Network
  - Orchestration
- Programmability

Telco COs - Cloud Native

- Fully Software Defined
- Further Reduction in CAPEX and OPEX
- Disaggregated and flexible
- Massive Scale
- Edge Blueprint

COs Serve Residential Business & Mobile Customers
VCO 1.0 Recap

- 2017 OPNFV Summit in Beijing: Phase I of the Project: Residential Services and Enterprise Business Services live on stage (vOLT, VNFAaaS, BNG, etc)
- Generic blueprint for Central Office with open source components and OpenDaylight SDN controller
- Focus on residential and enterprise VNF on-boarding and assurance
VCO 1.0

Residential

Business
VCO Enables the Mobile Edge
Telecom Provider Requirements

- Massive Scale → “Distributed Hyperscale”
- Common deployment model for Data Center and CO locations
- OpenStack and/or Kubernetes
- Flexible and Agile
- LTE and 5G Radio with vEPC & NG-Core
- Centralized Management and Troubleshooting
- Service assurance - Metrics and Events
- End-to-End Orchestration

VCO Demo Checklist

- vRAN/CRAN for LTE
- vRAN LTE low layer split (RoE)
- vRAN LTE high layer split (F1-like)
- Low latency service
- Network slicing*
- Single LTE vEPC
- IMS and VoLTE*
- Ansible based orchestration
- Service assurance & monitoring
- Mix of bare metal, VMs, (containers*)

* Goal for future VCO demo
VCO 2.0 Stack

ONAP Orchestrator

NFV Orchestrator, Service Assurance (Met Mon)

Element Manager

Element Manager

Element Manager

VNF Manager

VNF(s) vBNG

VNF(s) vRouter

VNF(s) FW

VNF(s) FW

SDN Controller

NFVI

Servers/HW

White Box Switch Fabric
Lab Physical Topology

[Diagram showing various components such as switching, controllers, compute, storage, and external connections like Internet, jump host/provisioner/gateway, software defined radio, and faraday cage.]
VCO Demo – Live Cross Atlantic Call on 5G Core
Looking Ahead – Get Involved!

› Join VCO Demo Mailing List: opnfv-vco@lists.opnfv.org
› Participate in Future Versions of VCO
› Participate in the Pharos Lab Program
› Work with LFN and OCP to host lab demo versions
› Join the OPNFV CRAN, Edge, Rocket projects
› Operationalize CI/CD, Automated Testing, Pharos Labs
› Define cross-project Cloud Native evolution
The Linux Foundation Partners with ORAN Alliance to Collaborate on Open Source Software Development Fueling 5G

Collaboration between ORAN Alliance and The Linux Foundation signals further harmonization between open source software and open organizations

AMSTERDAM, Sept. 25, 2018 – The Linux Foundation, the nonprofit organization enabling mass innovation through open source, today announced it is partnering with the ORAN Alliance, a worldwide, carrier-led effort to drive new levels of openness in the radio access network of next generation wireless systems, to enable the creation of open source software compliant with ORAN architecture and interfaces.

The Linux Foundation will host a new project to facilitate development of open source software in tandem with the Alliance as it continues to drive standards and specify APIs and interfaces.
Participating in LF Networking
LF Networking (LFN) Projects Power Next Generation Orange Networks

**Challenge**
Full network automation, achieve full-benefits of SDN/NFV, retrain company for rapid evolution of software solutions

**Solution**
Actively participate in LFN Projects / incorporate into real use cases

**Benefits**
› Testing/Interop of NFV Architecture
› VNF/Servier Onboarding & Design
› Full Network Automation
› Time To Market
› Culture Change

Ambitious strategy includes 5G trials in France for 2018, and Orange aims to deliver an operational 5G network by 2020

Orange Plans '5G Plus Automation' RFP This Year
“Orange plans to use ONAP as the single interface to all automated processes.”

LightReading

Critical components of Orange’s next generation SDN/NFV initiatives to enable 5G, big data, AI and IoT network services.
Commercialization of Open Source

Engagement across the ecosystem and commercialization of products and services are required to create and sustain a vibrant ecosystem

› **Vendors:** Invest in the future by leveraging open source for non-differentiated R&D

› **Integrators:** Provide end-to-end integration and deployment solutions

› **Operators:** Consume, collaborate and help shape the supply chain

› **Developers:** Join projects, start projects, fail fast, lead, innovate, transform
It Pays to Give Back

It is a competitive advantage for companies to allow developers to contribute.

"New research by Assistant Professor Frank Nagle, a member of the Strategy Unit at Harvard Business School, shows that paying employees to contribute to such software boosts the company’s productivity from using the software by as much as 100 percent, when compared with free-riding competitors."

https://hbswk.hbs.edu/item/the-hidden-benefit-of-giving-back-to-open-source-software
There are lots of ways to get involved!

- Join TSC calls and subscribe to project mailing lists
- Attend Hackfests, Plugfests and developer events
- Contribute to release documentation
- Provide your deployment feedback through the EUAG
- Search for Open Bugs, or Report a New One, in the project JIRAs
- Start or join a local DSN User Group Meetup
- Define compliance and verification test cases
- Review and submit code patches

› Join the Linux Foundation and LFN
› Invest in your personnel
› Participate in the technical communities
› Take a training course

› Follow best practices and develop your own
› Empower yourself with knowledge
› Begin Anywhere
› LFN-info@linuxfoundation.org
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