• A Collaborative Platform for Business and Technology Innovation

Ayush Sharma
Sr. VP & CTO-Networks
Open Networking Reference Stack

- Programming Frameworks
- Application Platforms
- VM/VIM Managers
- Containers
- Operating & Orchestrating Systems
- Virtual Machines
- Carrier Networking
- Network Controller
- Programmable Data Plane Services
- Hardware
5G
NFV
Open Source
SDN
Gigaband
Network slicing (5G Network Software Framework*)

- **Bare Transport Layer**
  - IoT
  - Video
  - V2V
  - DTN
  - Network Slicing Framework
  - TCP/IP Services slice
  - ICN Service Slice
  - Network Slicing Framework
  - ICN / IP Service Orchestration Plane

**ICN Service Slice**
- X86 Servers
- ICN/IP VM Services
- VSwitches

**TCP/IP Services slice**
- X86 Bare Metal Servers
- Hosting IP/ICN forwarder and Service VMS
- Network/Service Functions
- VSwitches

**Agile Flow Switching**
- Programmable IP/ICN layer binding to L2
- VSwitch for flow level programmability

**Elastic Service Packet Delivery**
- Each slice may be independent of each other

* FG, IMT 2020 - “Network Standardization Requirement for 5G”
Compete or Collaborate for Common Goals

**Standards Definition**
- Application Architecture
- Architecture & Requirements
- Protocols & Models

**Open Source Implementation**
- **OPNFV**
- **ONOS**
- **OpenDaylight**
- **OpenStack**
- **KVM**
- **OpenvSwitch**

**Solution**
- Controller
- Cloud OS
- Forwarding & Hardware
Open & Customer-Centric R&D

Common Goal: Lab/Field Trials Leading to a Reference Solution
Programming The Data Plane for
The Specific Network Slice
Open Programmable Data Plane-Protocol Oblivious Forwarding

- NOS: Box with Fixed Function ASIC
  - Gen 1
  - Decouple
  - Hide heterogeneity
  - Application reuse

- APP: Box with Programmable Chip
  - Gen 2
  - Config. time Programming
  - Custom application
  - One size fits all

- APP: Box with Programmable Chip
  - Gen 2+
  - Runtime Interactive Programming
  - Real time & on demand
  - Interactive & stateful
Data Analytics Using POF

POF-based Networks

Big Data Analytics

Dynamic Transactional Query

Present

Compile

Analyze

Disseminate

Collect

Configure

Data Analytics App

Configuration (e.g. P4)

Runtime (control & reconfig.)

SDN Controller (e.g., ONOS, ODL)

POF Interface

Interactive Programmable Device (POF-enabled)
Using SDN Controller Agnostic Intent Framework
Why Intent?

- Eliminate Vendor Lock-In
- Make solution components fungible
- Enable “programming the network” for non-experts
- Allow Write-once, Run-anywhere infrastructure integration
- Support dynamic behaviors of network applications and resources
Intent service middleware is a shim layer between service orchestrator & a controller. It provides a set of unified, intuitive and consistence interfaces to enable service innovation.
Orchestrating The Resources Across Domains
OPEN-Orchestrator Founding Principles

- Community
- OPEN Labs
- Funding
- Code
- Customer
- Community
The Linux Foundation announced the intent to form the OPEN-Orchestrator Project (OPEN-O). This collaborative effort will bring the industry together to develop the first open source software framework and orchestrator to enable agile software-defined networking (SDN) and network function virtualization (NFV) operations. The effort is detailed today at a press conference hosted by The Linux Foundation, China Mobile and Huawei at Mobile World Congress.

Operators Are Cordially Invited to Join Open-O
Building an Open Networking Reference Stack Using Reference Solutions
Please Visit Our Booth for Demonstrations Using The Stack Layers

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- Hardware
THANKS