Welcome!
Transforming Operator Networks

with

Curated Open Source

Aseem Parikh

VP Solutions & Partnerships
ONF’s Operator Led Mission

...and do so by leveraging

- Open Source
- SDN/NFV/Cloudification
- Disaggregation White Box

Transform Operator Networks

...to bring capex & opex efficiencies & innovative services

Why?

How?
ONF – Operator Led Consortium

Collaborating to Address a Common Problem

Operators need cloud-like economics and agility

Incumbent vendors have not been providing open tools & cloud-like building blocks

With 13+ additional operators at ‘Innovator’ level
Supported by a Committed Group of Supply Chain Partners
Operator Led - Curated Open Source Community

Partners committed to disaggregation, open source and SDN/NFV/Cloudification

ONF BOARD
- Andre Feutsch – CTO & ONF Chair
- Jochen Appel – VP
- Amin Vahdat – Fellow
- Dai Kashiwa – Director
- Rob Howald – VP
- Shao Guanglu – SVP
- George Tchaparian – CEO
- Yusuf Kirac – CTO
- Nick McKeown – Prof
- Guru Parulkar, Exec Dir
ONF’s Yin-Yang Model for Disaggregation & Integration

To enable innovation need:
Disaggregation and Open Source Components

To be able to deploy:
Operators Require Integrated Solutions Leveraging Open Source Disaggregated Components

ONF is unique in delivering **Integrated Solutions** leveraging open source **Disaggregated Components**
ONF Open Source Components

- **XOS**: A Service OS for service management, composition, orchestration
- **Services**: A Portfolio of Mobile, Residential, & Enterprise Services
- **OMEC**: A Disaggregated Virtualized EPC

**ONOS**: An SDN OS for control and config designed for scale, performance, HA

- **Stratum**: Packet Switches
- **VOLTHA**: OLT: Optical Line Terminator
- **xRAN Controller**: RAN RU/DU
- **OLS/ROADM**:
CORD – Next Generation Edge Cloud Platform

Cloud Native Services
- Mobile
- Enterprise
- Residential

Open Source Software Stack

Specialized Access Equipment
- Radio Units
- PON OLTs
- Cable DOCSIS

White Box Switches

White Box Servers & Storage

Specialized Optical DWDM

Backbone
ONF’s Interconnected Set of Curated Open Source Projects

Access

Edge

Core
ONF’s Interconnected Set of Curated Open Source Projects

Access

Trellis
NFV Fabric

Edge

ONOS
SDN Controller

OpenFlow

Core

MOBILE

BROADBAND

COMMON SDN INFRASTRUCTURE

CORD
ONF’s Interconnected Set of Curated Open Source Projects

- **MOBILE**
  - O-RAN Controller
  - SEBA & VOLTHA
  - M-CORD
  - OMEC (Open Mobile Evolved Core)
  - R-CORD
  - Disaggregated Optical Transport (ODTN)

- **BROADBAND**
  - Subscriber Mgmt
  - R-CORD
  - ONOS (SDN Controller)
  - OpenFlow

- **ACCESS**
  - Trellis (NFV Fabric & SDN Backhaul)

- **EDGE**
  - ONOS
  - OpenFlow

- **CORE**
  - Seba & Voltha
  - M-CORD
  - OMEC
  - R-CORD
  - Trellis

- **COMMON SDN INFRASTRUCTURE**
ONF’s Interconnected Set of Curated Open Source Projects

- **MOBILE**
  - O-RAN Controller
  - SEBA & VOLT HA
  - Open Mobile Evolved Core
  - Disaggregated Optical Transport

- **BROADBAND**
  - R-CORD
  - Subscriber Mgmt
  - Open Mobile Evolved Core
  - Disaggregated Optical Transport

- **Access**
  - Trellis
    - NFV Fabric & SDN Backhaul

- **Edge**
  - Trellis
  - NFV Fabric & SDN Backhaul

- **Core**
  - O-RAN Controller
  - SEBA & VOLT HA
  - Open Mobile Evolved Core
  - Disaggregated Optical Transport

- **COMMON SDN INFRASTRUCTURE**
  - ONOS SDN Controller
  - Migrating to ONOS-NG
  - OpenFlow
  - Migrating to Stratum & P4
ONF’s Interconnected Set of Curated Open Source Projects

**Access**
- O-RAN Controller
- SEBA & VOLTHA

**COMAC**
(Converged Multi-Access & Core)
- OMEC
  - Open Mobile Evolved Core
- R-CORD
  - Subscriber Mgmt

**Mobile**
- Trellis
  - NFV Fabric & SDN Backhaul

**Broadband**
- ODTN
  - Disaggregated Optical Transport

**Core**
- ONOS
  - SDN Controller
- OpenFlow
- Next-Gen SDN
  - ONOS-NG
  - Stratum & P4

**Common SDN Infrastructure**
- Migrating to
- SEBA & VOLTHA
- O-RAN Controller
- ONOS
- OpenFlow
Operator Traction Worldwide

### AT&T
- SEBA, VOLTHA

### Blackfoot
- SEBA

### Verizon
- M-CORD

### Sprint
- M-CORD

### Comcast
- Trellis, ODTN

### Google
- Stratum, SEBA, NG-SDN

### AT&T:
- SEBA, VOLTHA

### Blackfoot:
- SEBA

### Verizon:
- M-CORD

### Sprint:
- M-CORD

### Comcast:
- Trellis, ODTN

### Google:
- Stratum, SEBA, NG-SDN

### China Unicom:
- M-CORD, E-CORD

### China Mobile:
- M-CORD, E-CORD

### NTT, NTT East:
- ODTN, R-CORD

### SK Telecom:
- M-CORD

### Reliance Jio:
- SEBA, M-CORD

### NBN:
- SEBA, VOLTHA

### Telstra:
- M-CORD

### Turk Cell:
- R-CORD

### Turk Telekom:
- SEBA, M-CORD
“70% of operators worldwide are planning to deploy CORD”

Michael Howard
IHS Markit

“Nearly 40% of all end-customers will have service provided by ... CORD by mid-2021”

Roz Roseboro
Heavy Reading

Operator Traction Worldwide

<table>
<thead>
<tr>
<th>Operator</th>
<th>Technology</th>
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<tbody>
<tr>
<td>AT&amp;T</td>
<td>SEBA, VOLTHA</td>
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<td>Blackfoot</td>
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70% of operators worldwide are planning to deploy CORD.
Reference Designs
Complementing Open Source with Operator Led Specifications
Reference Design Strategy

Operator agree on ‘Exemplar Platforms’ using selected components
Reference Design Strategy

REFERENCE DESIGN
Operators jointly create common specifications

OPEN SOURCE
Operator agree on ‘Exemplar Platforms’ using selected components
Reference Design Strategy

A OPEN SOURCE
Operator agree on ‘Exemplar Platforms’ using selected components

B REFERENCE DESIGN
Operators jointly create common specifications

C DEPLOYMENTS
Operator RFPs based on these designs

Reference Designs become “gold standards” for basis of RFPs

Operators commit to trials and deployments

OPEN SOURCE

Exemplar Platforms
Solutions
Trials
Deployments

REFERENCE DESIGN

Operators agree on ‘Exemplar Platforms’ using selected components

DEPLOYMENTS

Operator RFPs based on these designs

REFERENCE DESIGN
Operators jointly create common specifications
Reference Design Strategy

Operators jointly create a common specification for Reference Designs.

Reference Designs become "gold standards" for basis of RFPs.

Reference Designs:
- SEBA – Virtualized Broadband
- Trellis – NFV Fabric & SDN Backhaul
- ODTN – Disaggregated Optical Transport
- NG-SDN – Next Gen SDN
- COMAC – Unified Mobile & Broadband

Exemplar Platforms:
- ONOS – SDN Controller
- OMEC – Mobile Core
- Stratum - NG-SDN Thin Switch
- VOLTHA – Virtualized OLT
- XOS/NEM – Service construction & OSS Mediation
- P4 – Forwarding Plane Programming Language

There is a paired Exemplar Platform for every Reference Design.

Solutions:

Trials

Deployments

Operator RFPs based on these designs.

"Towards" for basis of RFPs
Virtualized Broadband Access - SEBA

Network Edge Mediator
Built on XOS, and adds OSS mediation & FCAPS support for operationalization
Trellis: A Leaf-Spine Fabric for NFV

- Mobile Services
- Enterprise Services
- Residential Services

XOS
- Trellis
- ONOS
- OF-DPA, ONL & OCP
  - OpenFlow Switch

Comcast
AT&T

Leaf-Spine Fabric
White Box Packet Switches

ORAN
VOLTHA
ODTN

Disaggregated Radio Units
Disaggregated PON OLTs
Disaggregated PON OLTs
Shared Virtualized Servers: VMs & Containers
ROADM (To Core)

Residential Services
Mobile Services
Enterprise Services

NFV Fabric
Next-Gen SDN: Unified Programmable Autonomous Network (UPAN)

Mobile Services
Mobile

Enterprise Services
Enterprise

Residential Services
Residential

UPAN

XOS

Trellis-NG

ONOS-NG

Stratum

ORAN

VOLTHA

ODTN

NG-SDN Stack
P4, P4Runtime, OpenConfig/gNMI, gNOI

Leaf-Spine Fabric
White Box Packet Switches

Disaggregated Radio Units
Disaggregated PON OLTs
Disaggregated PON OLTs

Shared Virtualized Servers: VMs & Containers

ROADM (To Core)
ODTN: Open Disaggregated Transport Network

- Mobile Services
- Enterprise Services
- Residential Services

XOS

- Trellis
- ONOS
- Stratum

Leaf-Spine Fabric
White Box Packet Switches

Disaggregated Radio Units
Disaggregated PON OLTs
Disaggregated PON OLTs

Shared Virtualized Servers: VMs & Containers
ROADM (To Core)
ONF Having a Real Impact

Platform

- SEBA
  SDN Enabled Broadband Access

- Trellis + ONOS
  SDN Leaf-Spine Fabric/Backhaul

- Stratum + NG-SDN
  Thin Switch OS with Next Gen SDN Interfaces

- ODTN
  Disaggregated Optical Transport

- COMAC & OMEC
  Unified Access and Unified Core

Status

- Significant trials
  AT&T, DT, Turk Telekom, Telefonica, ...

- In Production

- Google’s Production Network at Scale

- NTT and Telefonica Lab Trials

- Sprint and DT Field Trials
  Platform for 5G

Project Synergies
Build Toward a Common Goal

CORD
A Platform for Edge Cloud

Build Toward a Common Goal
In Summary

ONF Enables

Transformation of Operators’ Access & Edge

Disaggregation White Box

Open Source

SDN/NFV/Cloudification

With Curated Open Source

...by leveraging

Trellis: NFV Fabric
SEBA: SDN Enabled Broadband Access
Next Gen SDN Stack
COMAC: Converged Multi Access & Core
Call Out

• ONF Pioneers have ‘bled’ the way driving transformation
  • Making Open Source, White Box and Disaggregation Possible
• You can now benefit and build on all this work
• Tremendous opportunity to create new business models and help drive the agenda for this new open source era

Reach out if you’d like to explore collaboration opportunities

Aseem Parikh
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Thank You