OPEN Compute Project

TAIWAN Regional Community

OCP TAIWAN DAY

Road to 5G · AI · Edge Computing

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Enabling Telco Edge Cloud with Open Source Software and Disaggregated Hardware

▶ Charles Chan, Open Networking Foundation

ONF

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ONF Overview

ONF: Operator Led Consortium

AT&T

China unicom中国联通

COMCAST

T

Google

NTT Group

Türk Telekom

With 13+ additional operators at ‘Innovator’ level

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

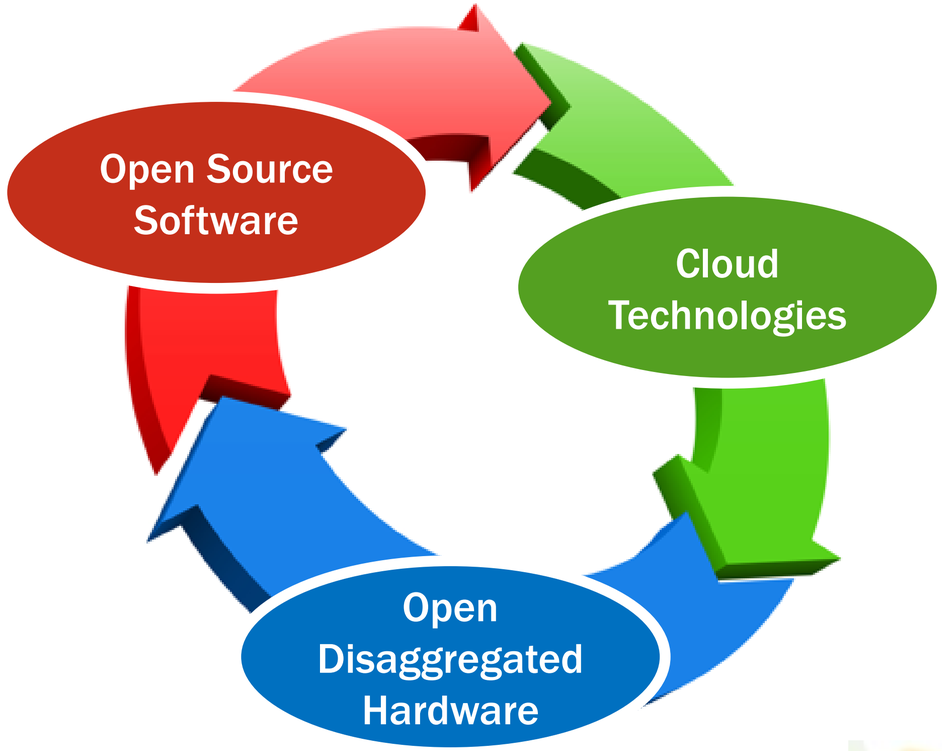
ONF

ONF Mission

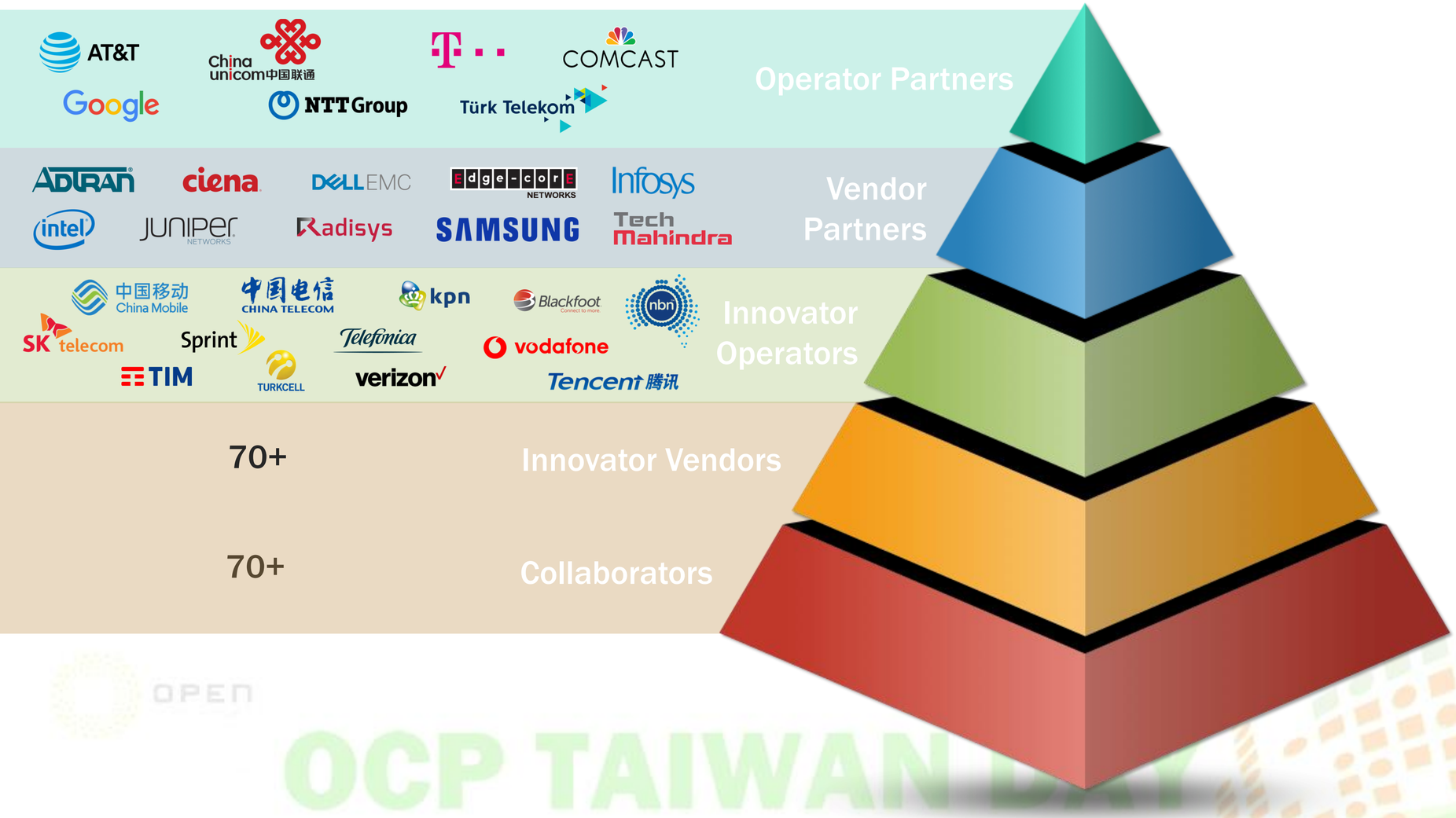
Transform Operator Networks

Bring CapEx/OpEx efficiencies & enable innovative services

...and do so by leveraging



Operator Led Curated Open Source Community



ONF BOARD

AT&T	Andre Feutsch - CTO & ONF Chair
T	Jochen Appel - VP
Google	Amin Vahdat - Fellow
NTT Group	Dai Kashiwa - VP
COMCAST	Rob Howald - VP
China unicom中国联通	Shao Guanglu - SVP
Edge-corE NETWORKS	George Tchaparian - CEO
Türk Telekom	Yusuf Kirac - CTO
STANFORD	Nick McKeown - Prof
ONF STANFORD	Guru Parulkar - Exec Dir

ONF Community in Taiwan

Complete List: https://www.opennetworking.org/member-listing/

Partner

Edge-corE NETWORKS

Collaborating Innovator

QCT

Inventec

DELTA

LINKER

Innovator

wiwynn

Nephos

Collaborator

EstiNet

NETBERG

國立交通大學 National Chiao Tung University

國立中正大學 National Chung Cheng University

Exploring

MiTAC

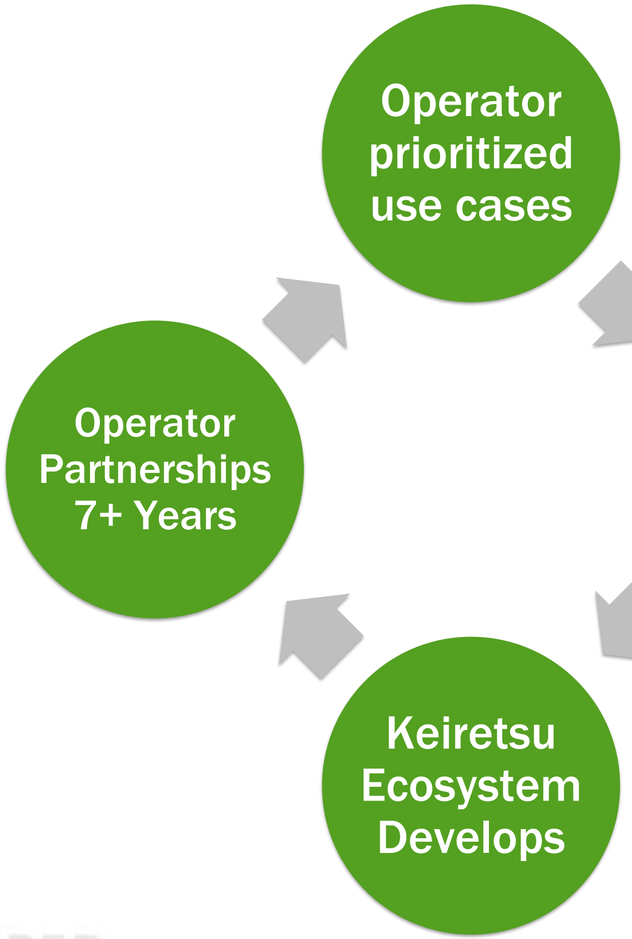
中華電信 Chunghwa Telecom

... and more

ONF Ambassador

5 active in Taiwan

Operator Led Curated Open Source Community



- Operators first agree on common use cases to jointly pursue
- Operators commit to deployment

- “Small & mighty” independent engineering team
- Dedicated to the mission with no legacy to protect

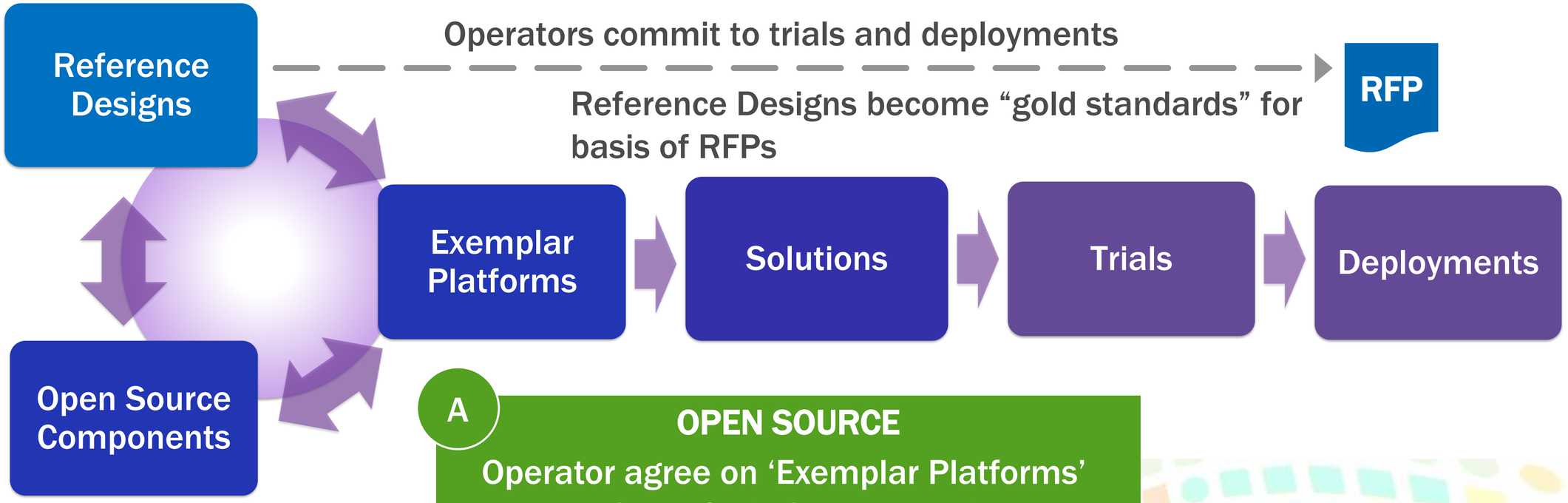
- Curated supply chain engages to embrace opportunity
- Well aligned vendors each contribute value to overall solution
- Operator commitment to deployment ensures ROI

Reference Design Strategy

B **REFERENCE DESIGN**
Operators jointly create common specifications

C **DEPLOYMENTS**
Operator RFPs based on these designs

AT&T
China unicom中国联通
COMCAST
Google
T
NTT Group
Türk Telekom



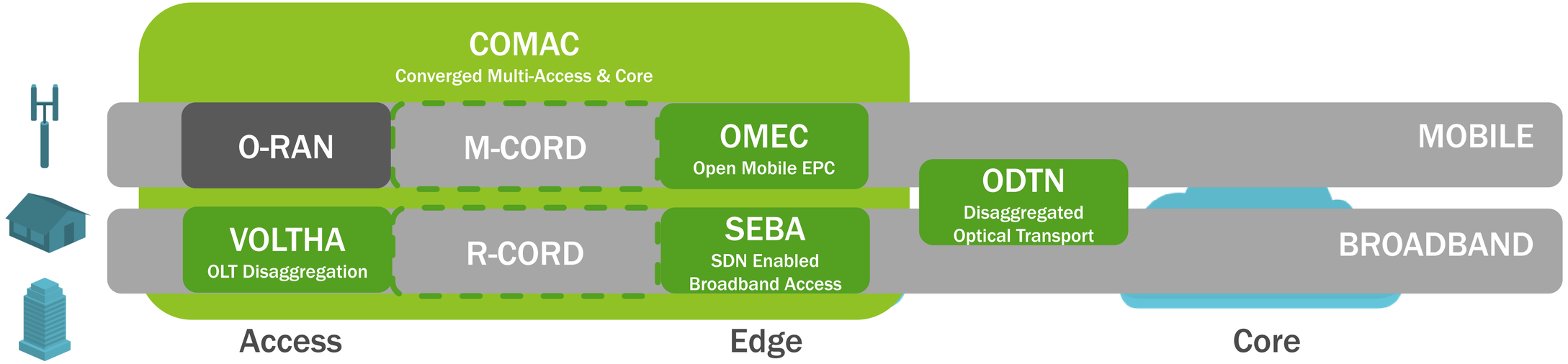
A **OPEN SOURCE**
Operator agree on ‘Exemplar Platforms’ using selected components

Different & Complementary to Other Initiatives

- **Unique Operator Led Curated Open Source Model**
- **Open source organization with an engineering team**
  - ONF Lab enables and accelerates implementations
  - Can pursue a disruptive agenda when incumbents resists investment
- **Driving Disruption – Essential at the Access and Edge**
  - Majority of CapEx costs are at operator edge
  - Therefore we see open white box architectures yielding massive efficiencies

ONF Solutions

ONF Solutions



Trellis
NFV Fabric & SDN Backhaul

ONOS
SDN Controller

OpenFlow
Control protocol

Migrating to

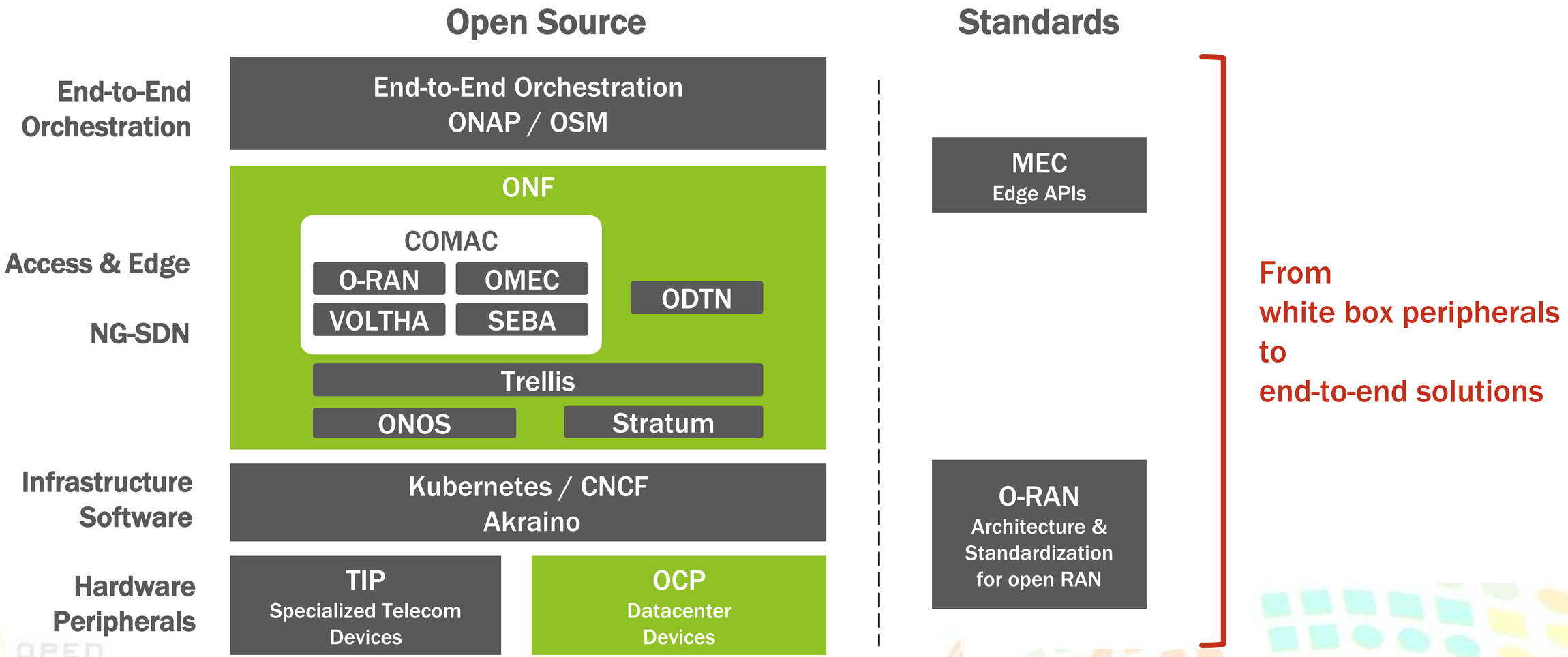
NG-SDN

µONOS
+ micro service,
device config/mgmt./op.

Stratum + P4
+ device config/mgmt./op.

Common SDN Infrastructure

ONF in Context of Open Source Ecosystem



ONF Having a Real Impact

Platform	Status
Trellis + ONOS SDN Leaf-Spine Fabric/Backhaul	In Production
SEBA SDN Enabled Broadband Access	Significant trials AT&T, DT, Turk Telekom, Telefonica, …
ODTN Disaggregated Optical	Lab Trials NTT-Comm, Telefonica, TIM
Stratum + NG-SDN Thin Switch OS with Next Gen SDN Interfaces	Google's Production Network at Scale
COMAC & OMEC 5G & Mobile	Sprint & DT Field Trials Platform for 5G

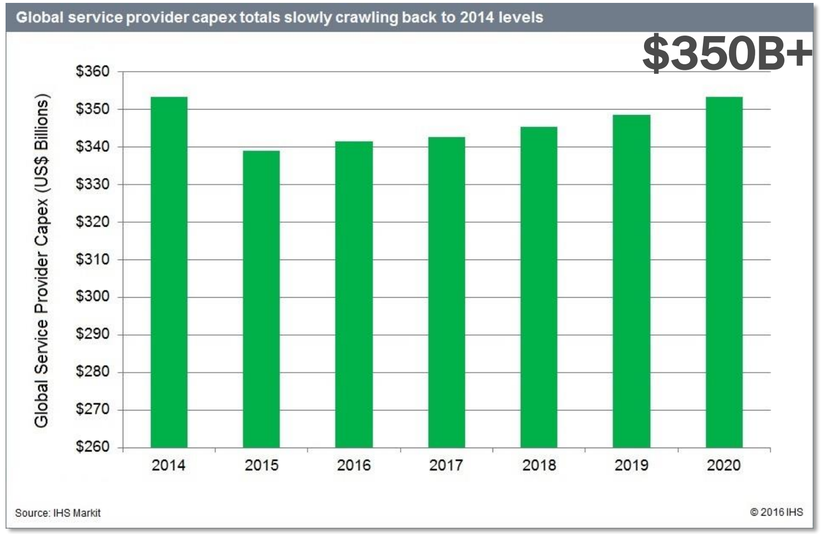
Project Synergies Build Toward a Common Goal

CORD

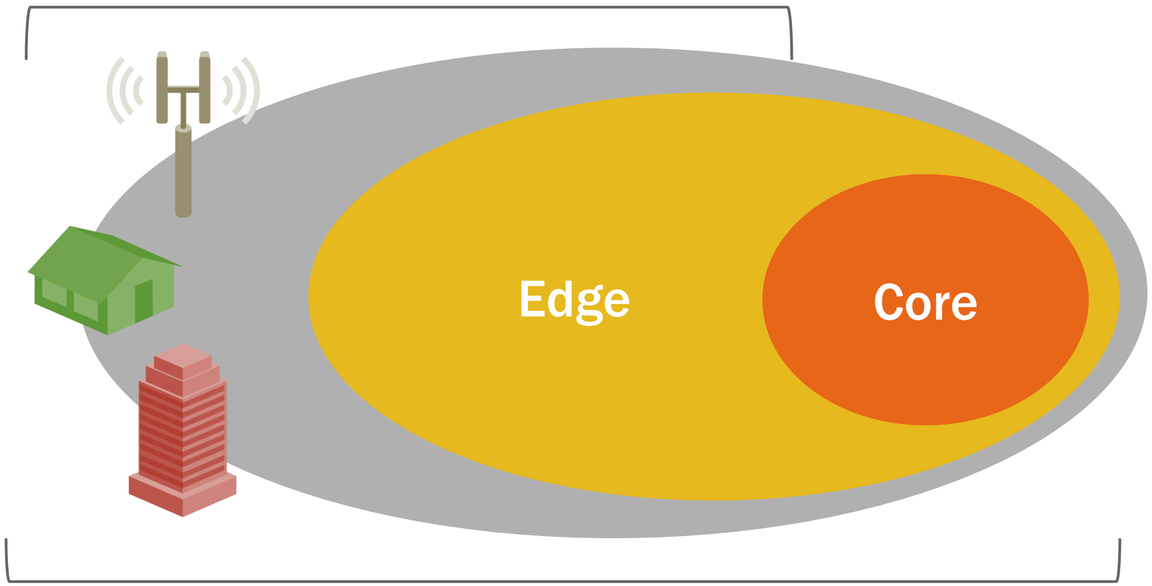
A Platform for Edge Cloud

Disrupting a $300B Market

Operator CapEx



$300B

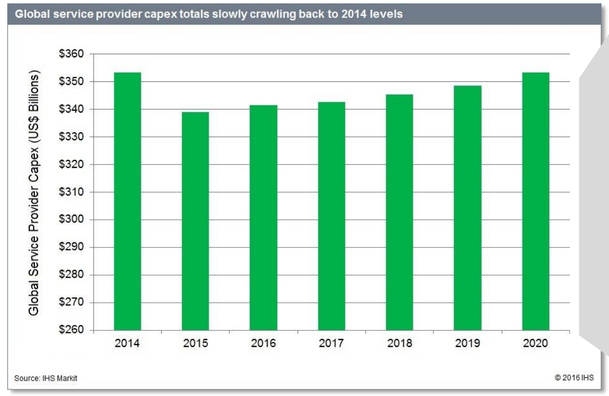


Operator CapEx $350B annually *
75-85% of this spend is at the “Edge” **
Note: Does not include integration, service and other OpEx

Sources:
* IHS Market
** ONF Partner Operators

New $30B opportunity being created

Spending will continue to increase year over year …



Operator CapEx

Legacy Spending Mix

Next Generation Spending Mix

Software

Hardware

Differentiating software

Non-differentiating platform software

Software & Services

Hardware

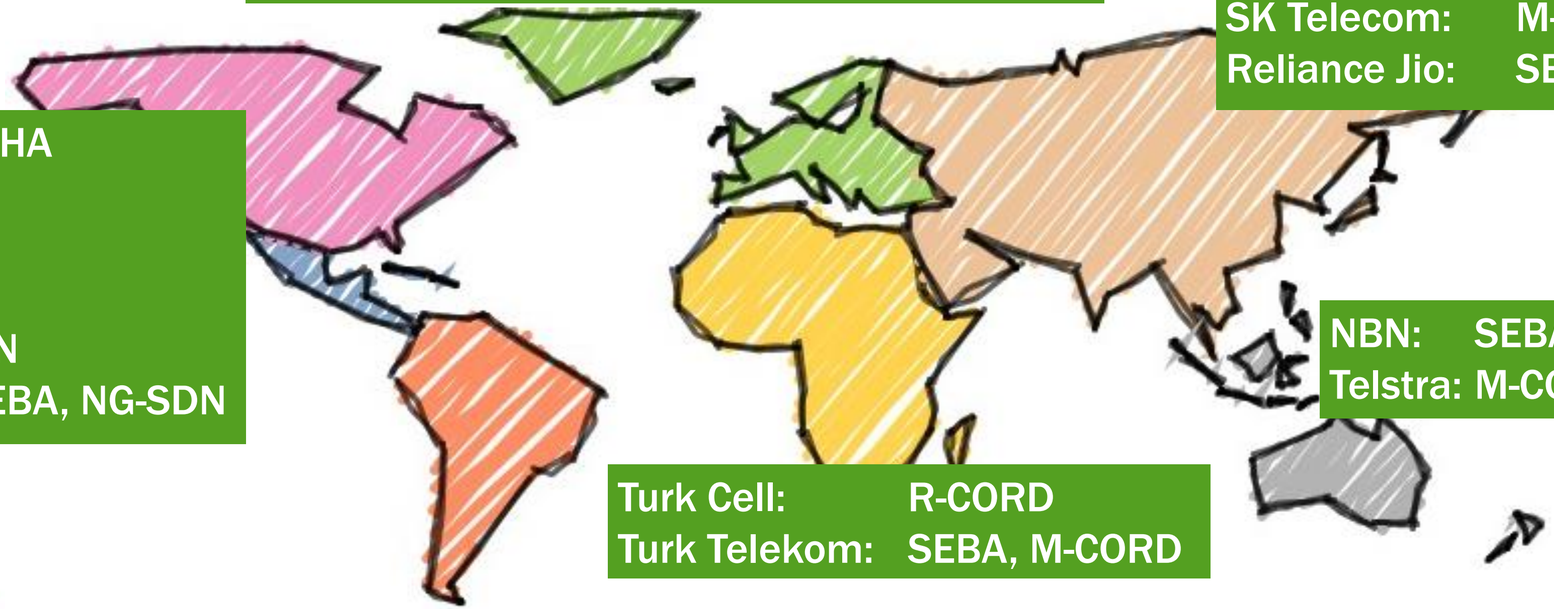
Open Source Software

Operators will convert spend to enable creation of new differentiated services

Operator Traction Worldwide

British Telecom:	R-CORD
Deutsche Telekom:	SEBA, M-CORD, NG-SDN
Swisscom(Fastweb):	R-CORD
KPN:	NG-SDN, Stratum
Telefonica:	R-CORD, M-CORD
Telecom Italia:	M-CORD
Colt:	R-CORD

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



AT&T:	SEBA, VOLTHA
Blackfoot:	SEBA
Verizon:	M-CORD
Sprint:	M-CORD
Comcast:	Trellis, ODTN
Google:	Stratum, SEBA, NG-SDN

NBN:	SEBA, VOLTHA
Telstra:	M-CORD

Turk Cell:	R-CORD
Turk Telekom:	SEBA, M-CORD

Operator Traction Worldwide

"Nearly 40% of all end-customers will have service provided by … CORD by mid-2021"

Roz Roseboro
Heavy Reading

"70% of operators worldwide are planning to deploy CORD"

Michael Howard
IHS Markit

How ONF Benefit from OCP

VOLTHA: OLT Disaggregation

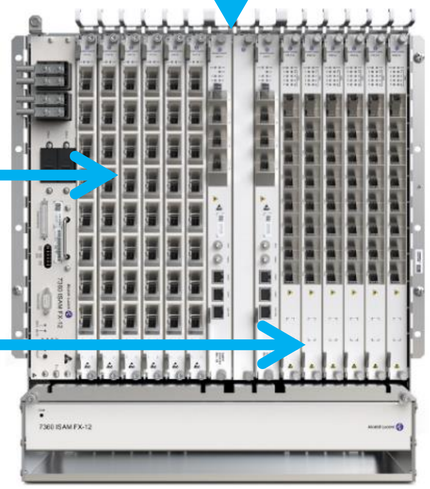
VOLTHA: Virtual OLT Hardware Abstraction

EMS VLANs, IGMP, 802.1x, Mcast ...

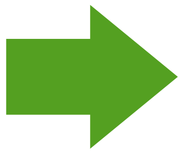
Backplane

PON MAC blades

Compute blades



Traditional Chassis based Vendor OLT for PONs (Passive Optical Networks)



VLANs | AAA | Mcast | ...

ONOS: SDN Controller

OpenFlow | NETCONF

OF Agent | NETCONF

OLT API | OMCI Stack

VOLTHA

OpenOLT Adaptor

OPEN ACCEPTED™

Whitebox XGS-PON OLT

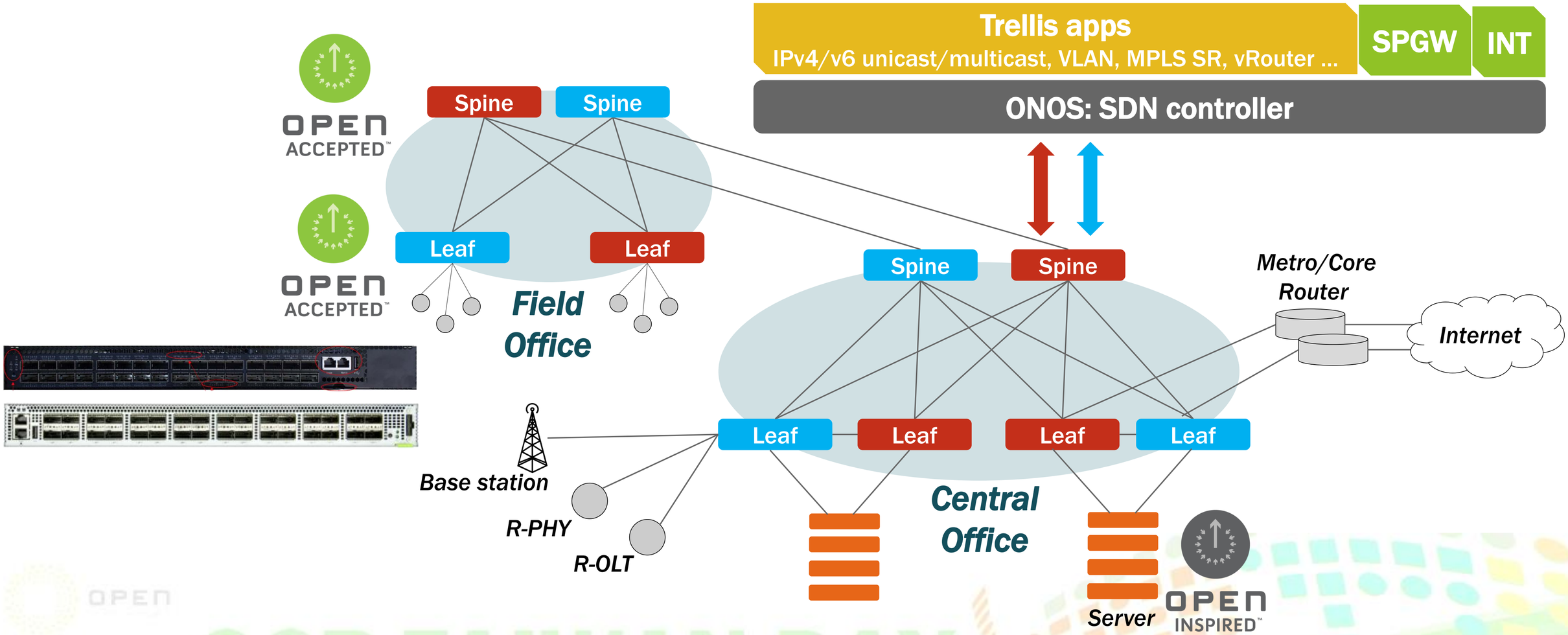
OpenOLT Driver

Chip Driver

ONL | SDK

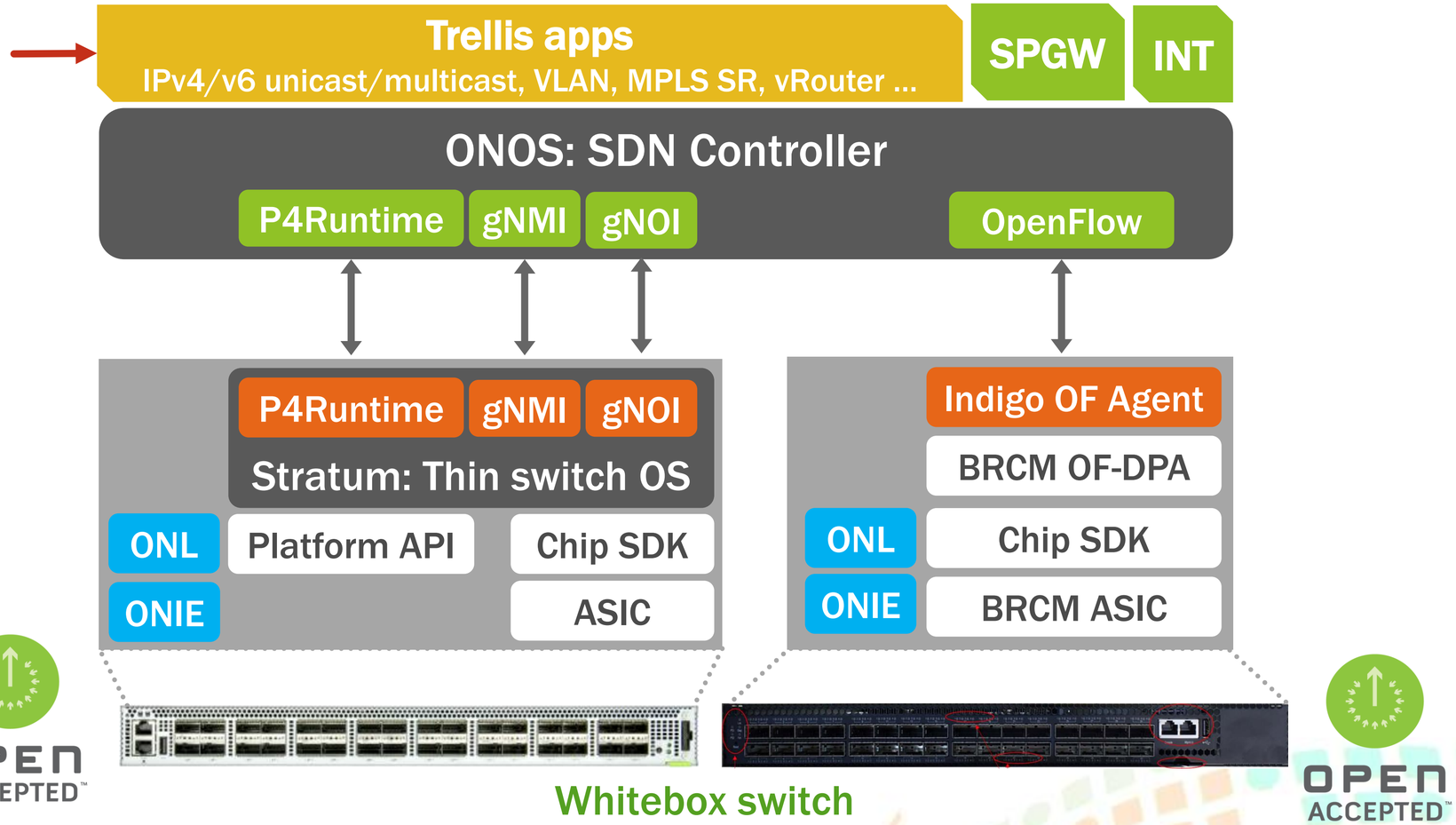
ONIE | ASIC

Trellis + NG-SDN: NG Networking Fabric



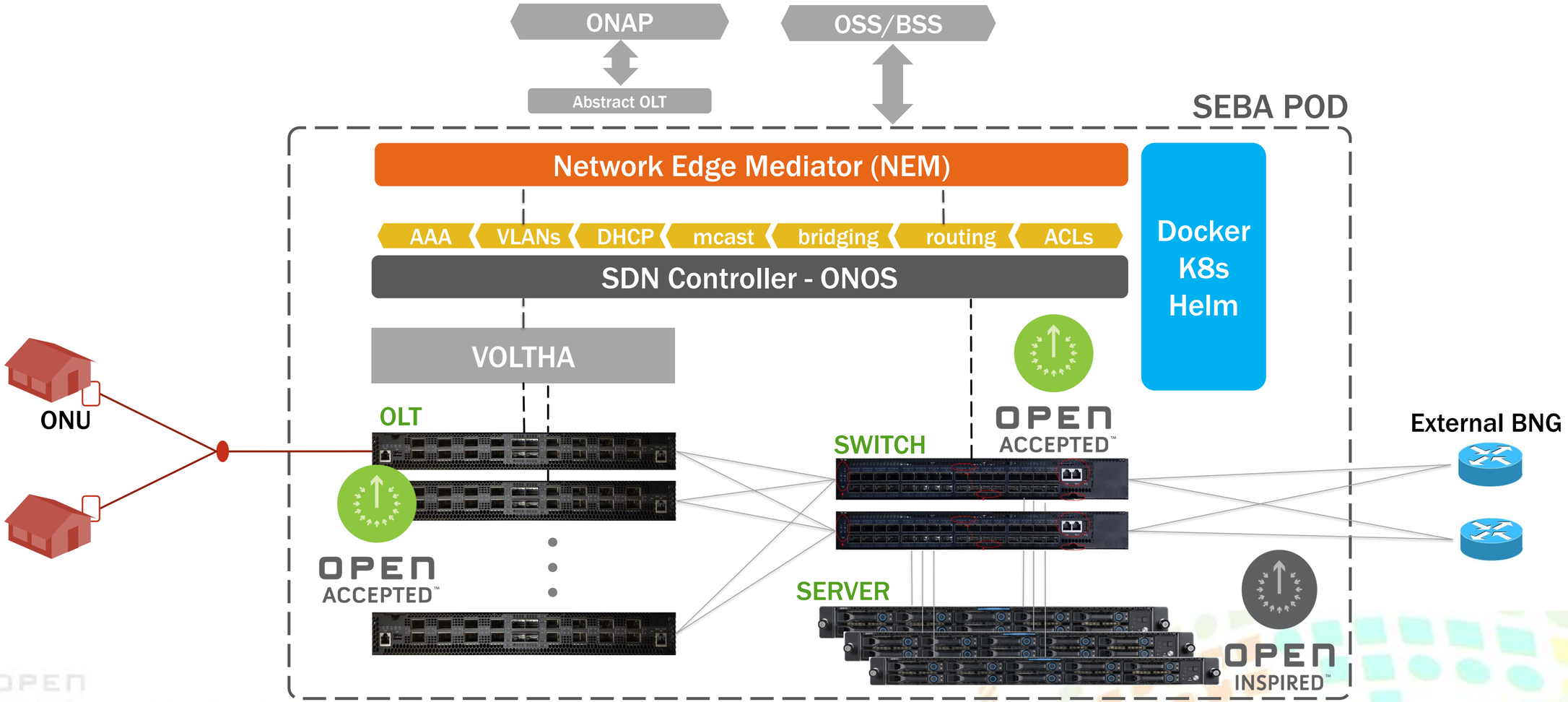
Trellis + NG-SDN: NG Networking Fabric

Same apps for different protocols/hardware



Whitebox switch

SEBA - SDN Enabled Broadband Access



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Summary

Summary

- **ONF: Operator driven curated open source**
  - Enable **telco edge cloud** with **open source software, disaggregated hardware** and **cloud technologies**
  - **CORD** is the flagship umbrella project
  - **SEBA** - SDN Enabled Broadband Access built on the CORD platform
- **Modular Components**
  - **VOLTHA** abstracts the PON as a quasi-Ethernet switch to the SDN controller
  - **Trellis** manages a multi-purpose leaf-spine fabric
  - **NG-SDN** enables innovative services with programmable pipeline and unified interface
- **All these projects benefit from OCP hardware**

How to Get Involved

- ONF
  - https://opennetworking.org
- ONF Connect 2019
  - https://www.opennetworking.org/onf-connect-2019/
  - Sep. 10 - 13 @ Santa Clara, CA
  - CFP is open until May 31
  - Take 15 minutes to submit the abstract and get free speaker ticket
- OCP Telcos/openEDGE
  - https://www.opencompute.org/wiki/Telcos/openEDGE


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Thank You