

# Agenda

- ❑ Overview of Flex
- ❑ ONF QA and Flex PODs
- ❑ CORD Certification Program
- ❑ SEBA POD
- ❑ SEBA Test Cases
- ❑ SEBA Test Results
- ❑ What's next with Flex & ONF QA

# We are Flex – Manufacturing & Design

**\$25B**  
revenue

**100**  
sites in over  
30 countries

**200,000**  
employees

**2,500**  
design  
engineers

**52M**  
sq. ft. of  
manufacturing &  
services space

**“Sketch to Scale”**

# Compute redistributes due to new workloads demands

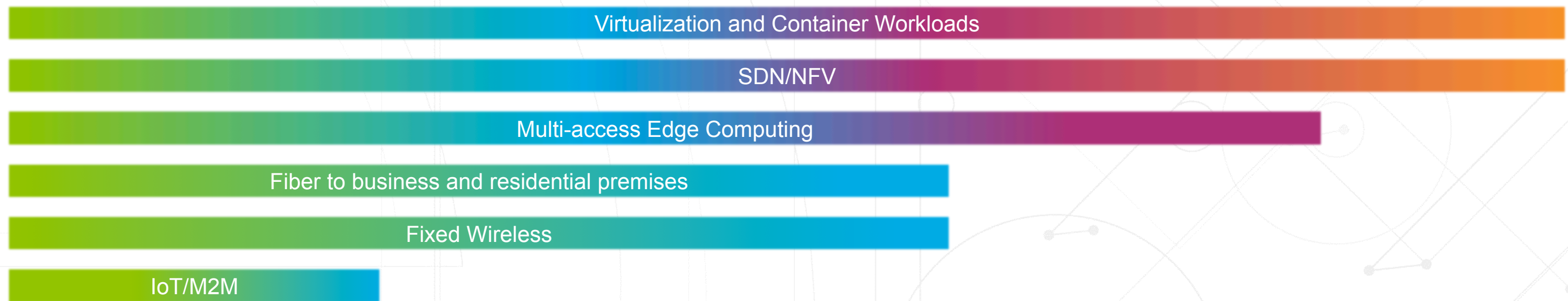
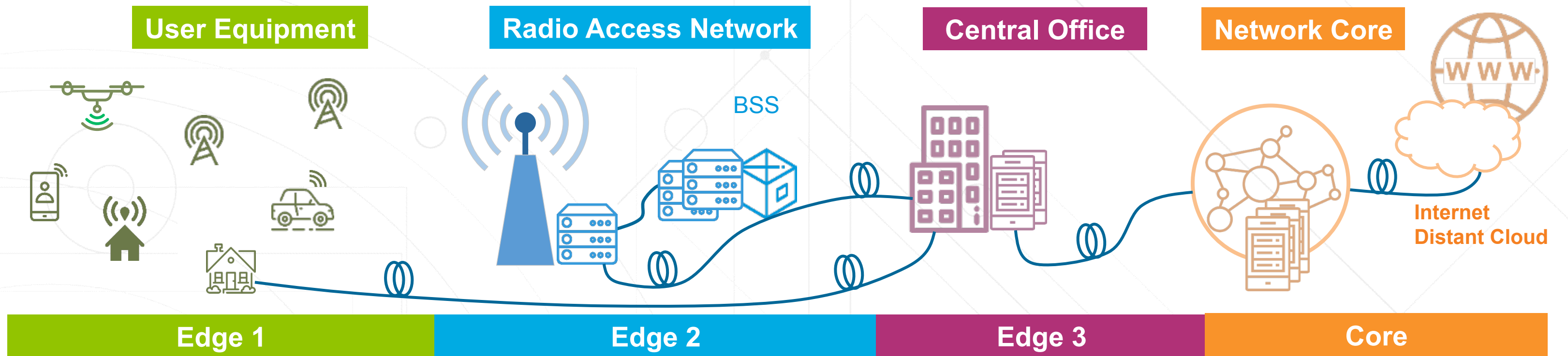
2000 - 2015



2015 - 2030



# Multiple edges, multiple technologies



# CORD: Next gen COs for the Service Providers

## CORD: Central Office Rearchitected as Data Centers

### Economies of a Datacenter

Infrastructure built with a few commodity building blocks using open source software and white boxes

### Agility for Service Provider

SDN enabled datacenter platforms enable rapid creation of new services



# Access to unique insights

Medical

Automotive

Industrial Goods

Home Appliances

Capital Equipment

Energy

\$2  
Billion

\$2  
Billion

\$1  
Billion

\$1  
Billion

\$1  
Billion

\$2  
Billion

## Cloud and Communications Solutions

Telecom

Networking

Compute / Storage

Wearables

Connected Living

Mobile

\$3  
Billion

\$3  
Billion

\$2  
Billion

\$1  
Billion

\$1  
Billion

\$2  
Billion

# Flex and CORD Relationship

Collaborators



Joined CORD in 2016



Resource and Lab Contribution



Today QA Lab for CORD

# Flex journey from CORD 1.0 to CORD 6.0 and beyond

H2 2016

CORD 1.0

**FIRST**  
Creamy-Vegetable



H1 2017

CORD 2.0

**SECOND**  
Mysterious-Decision



H1 2017

CORD 3.0

**THIRD**  
Dangerous-Addition



H2 2017

CORD 4.0

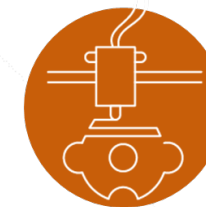
**FOURTH**  
Shared-Delusion



H1 2018

CORD 5.0

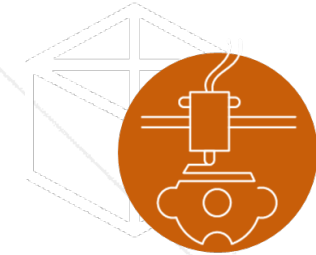
**FIFTH**  
Satisfying-Cactus



H2 2018

CORD 6.0

**SIXTH**  
Quizzical-Purpose



**Key development:**

- CORD-in-a-box deployments
- Single node cluster

**Key development:**

- Manual CORD deployments in lab
- Multi-node POD with 10G fabric network

**Key development:**

- Automated CORD deployments using Jenkins
- Multi-node POD with 40G fabric network

**Key development:**

- CORD community lab with remote connection facility
- Onboard partner test tools

**Key development:**

- Published CORD 5.0 QA reports
- OCP based multi-node community POD

**Key development:**

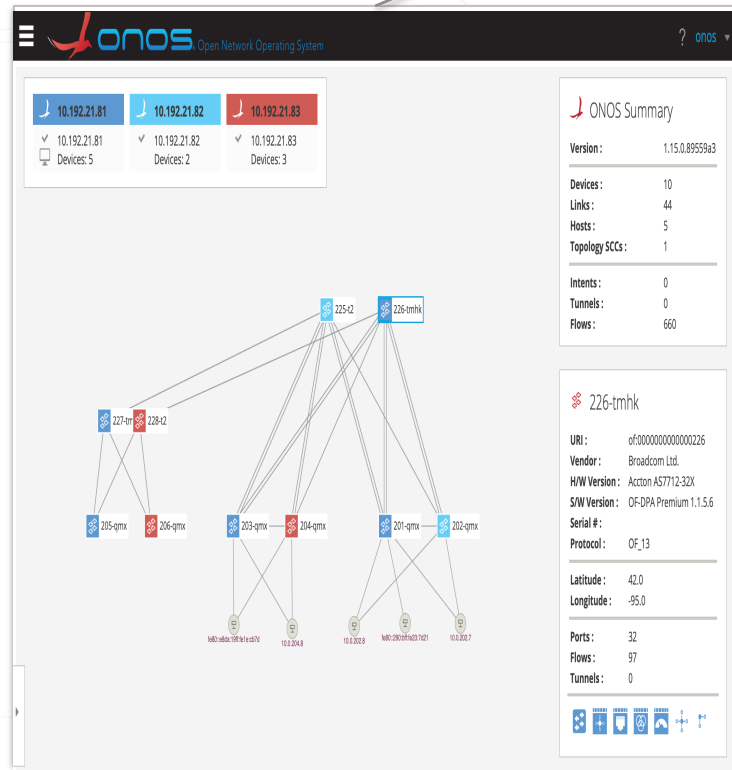
- Contribution to CORD Certification Program
- SEBA test plan demonstration



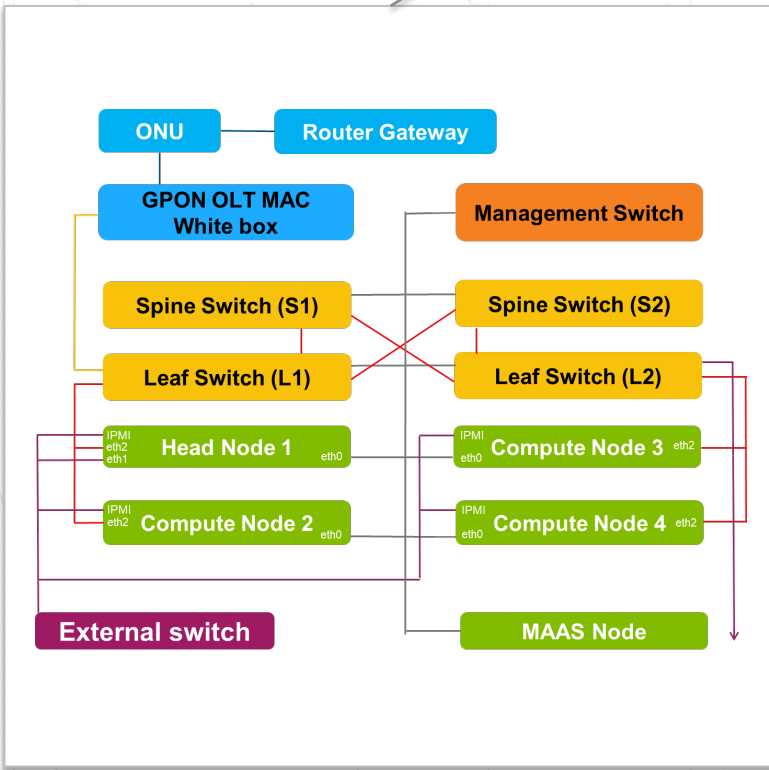
# POD Level Deployments at Flex



Flex "CloudLabs" VPN Network



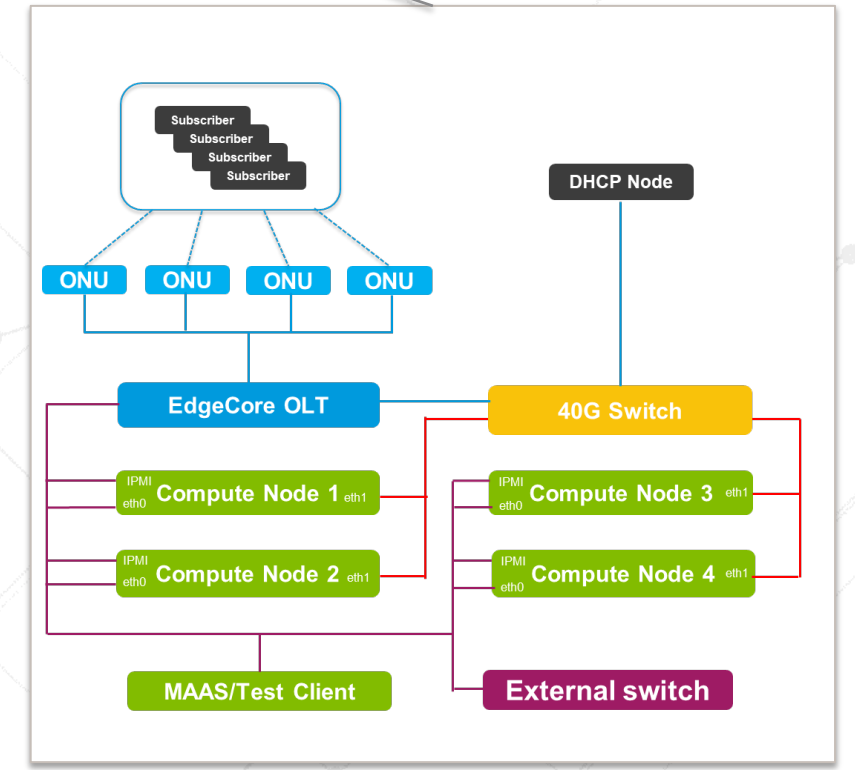
ONOS: Dev/Test



CORD: Full Fabric



CORD: Full Fabric on OCP

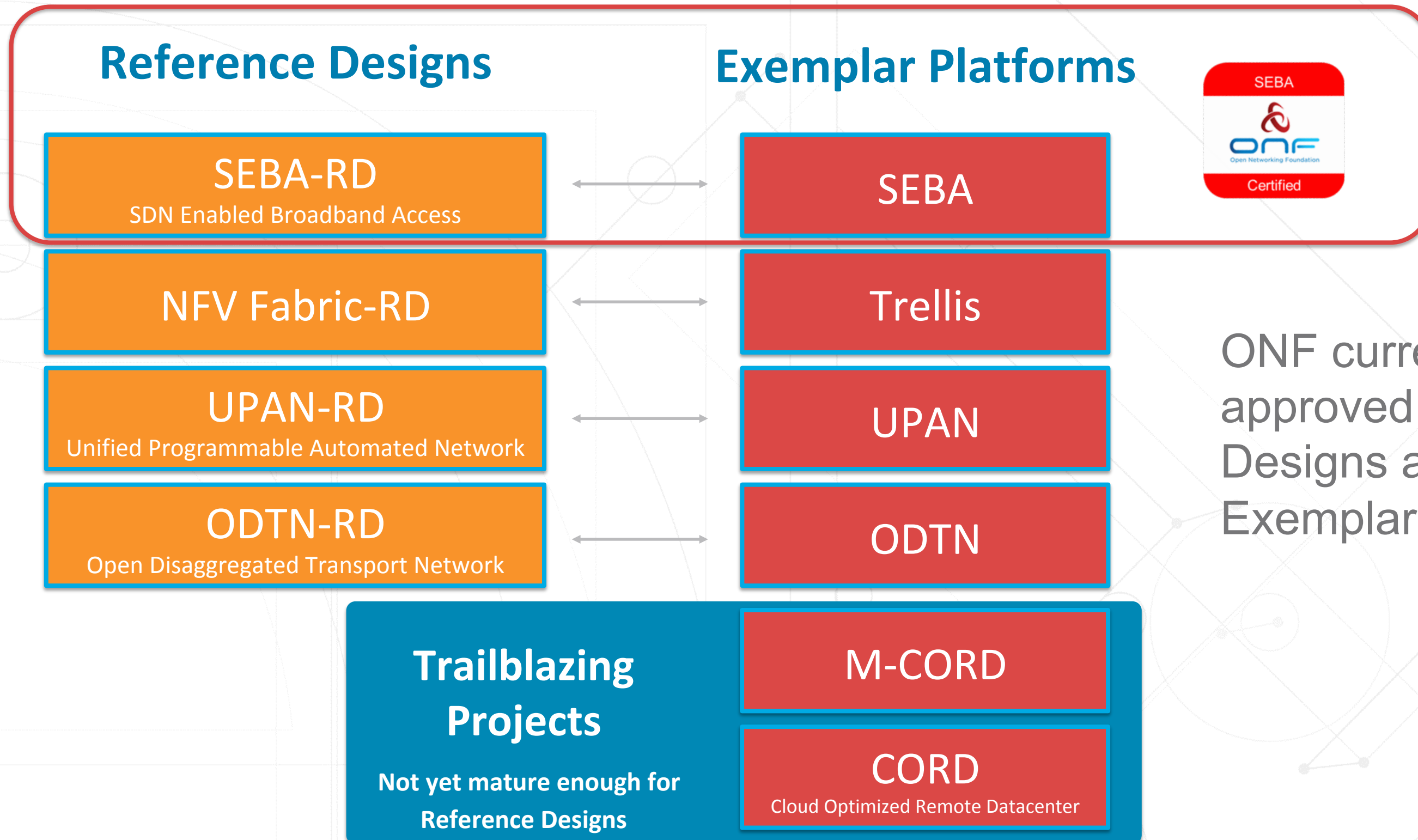


SEBA: Test Plan

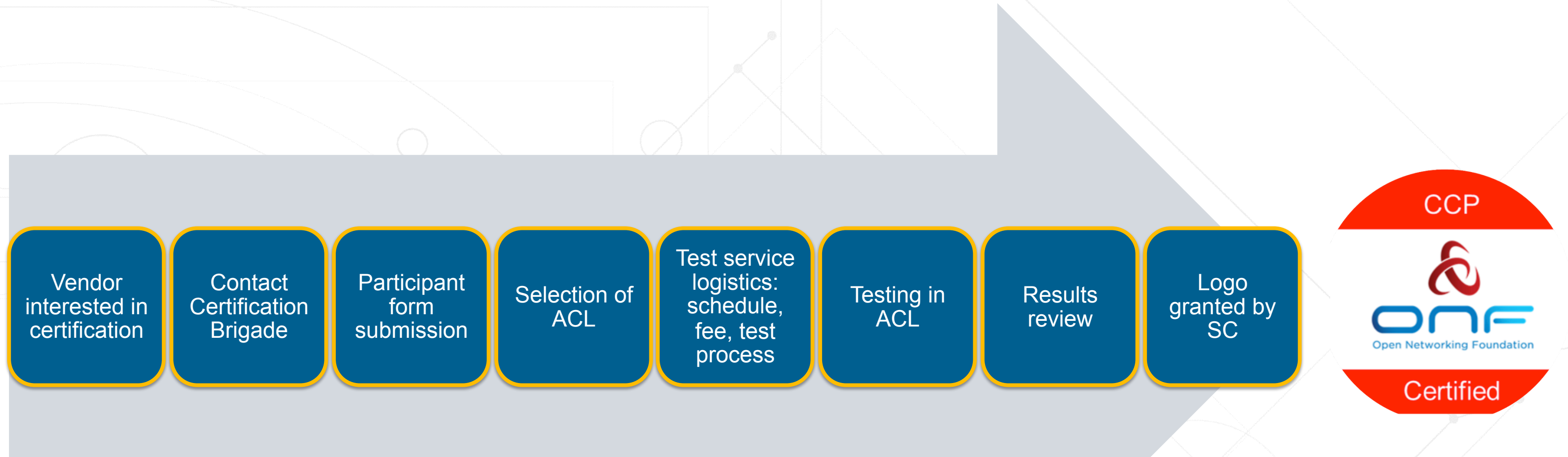


# ONF CORD Certification Program

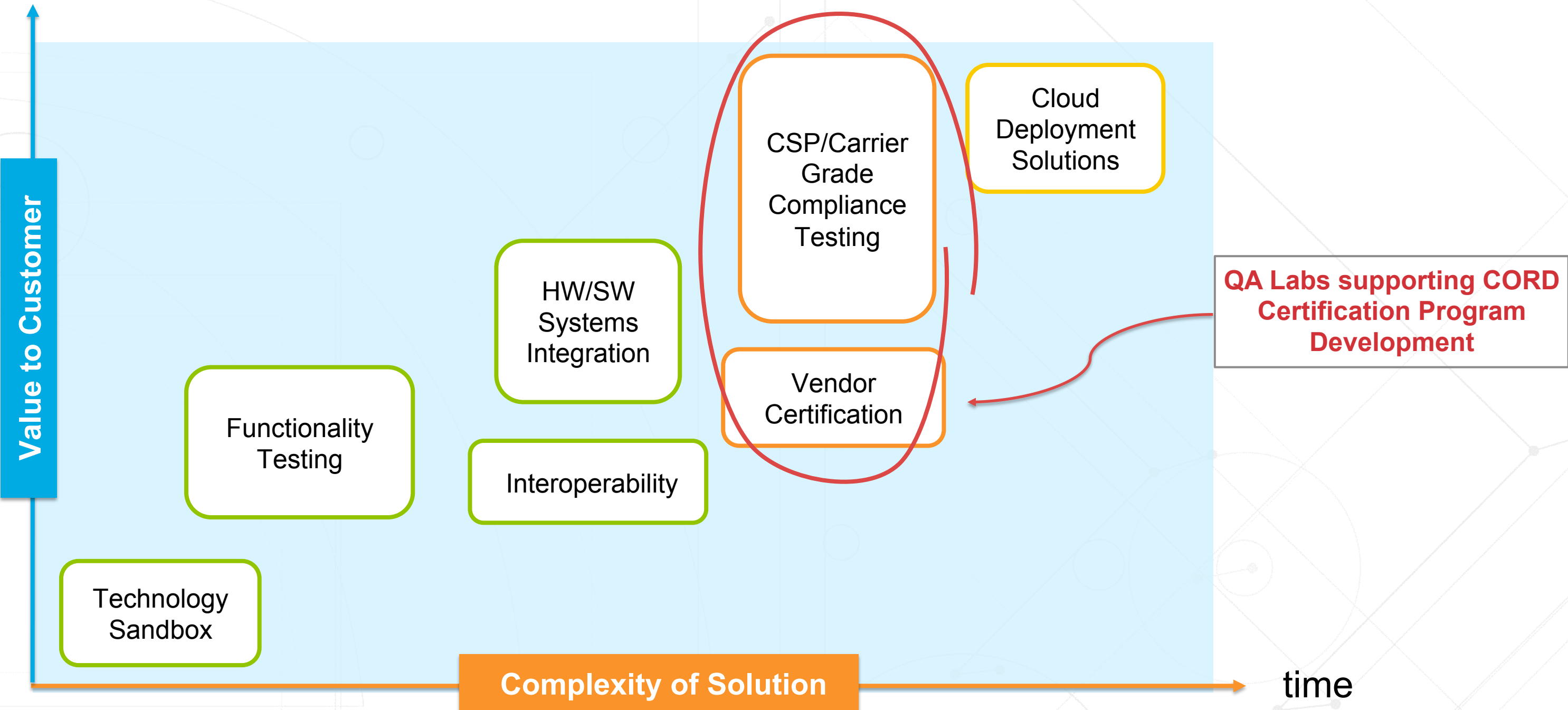
# SEBA is first certification domain



# SEBA Certification flow



# QA Labs and CORD Certification Program





# SEBA (SDN Enabled Broadband Access) POD

# SEBA POD Architecture

## Hardware

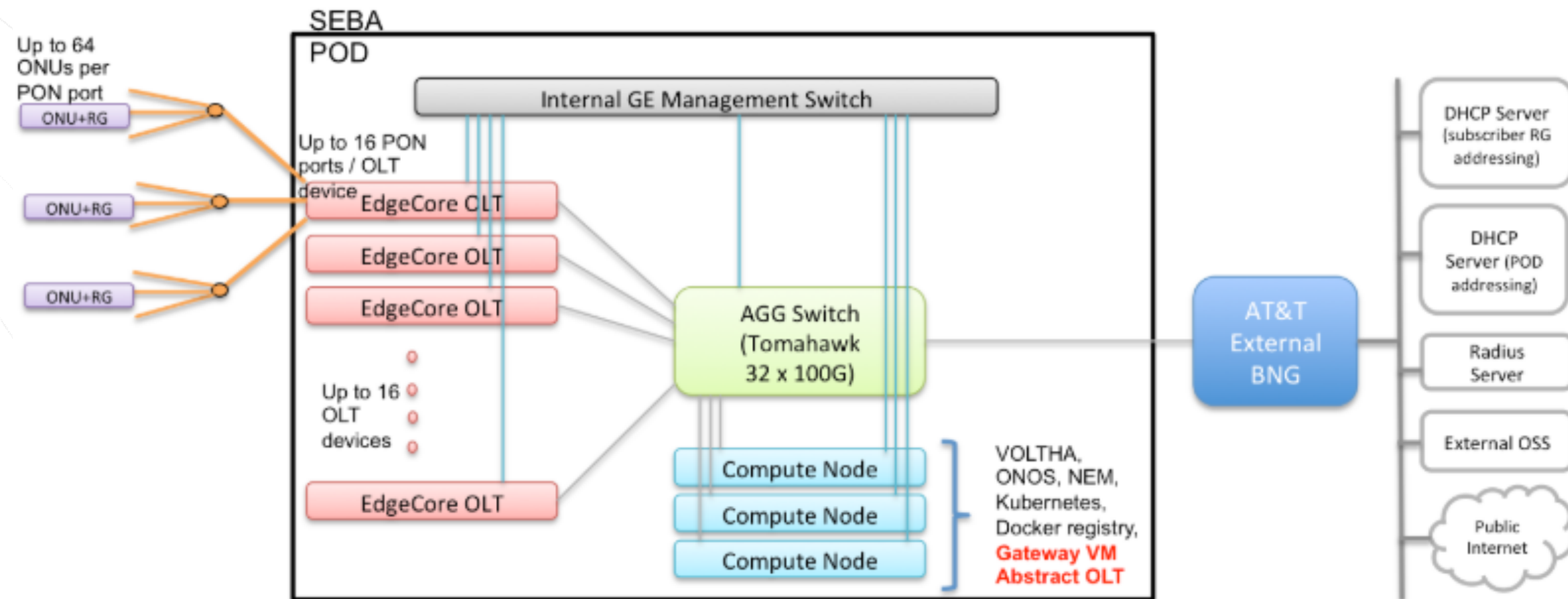
- 1 physical AGG switch (Tomahawk)
- 3 compute nodes connected to AGG switch
- Up to 16 EdgeCore OLTs with NNI port connected to the AGG switch
- Up to 64 ONUs on each PON port
- 1 GE management switch to which all OLTs AGG and compute node management ports

## Virtualization

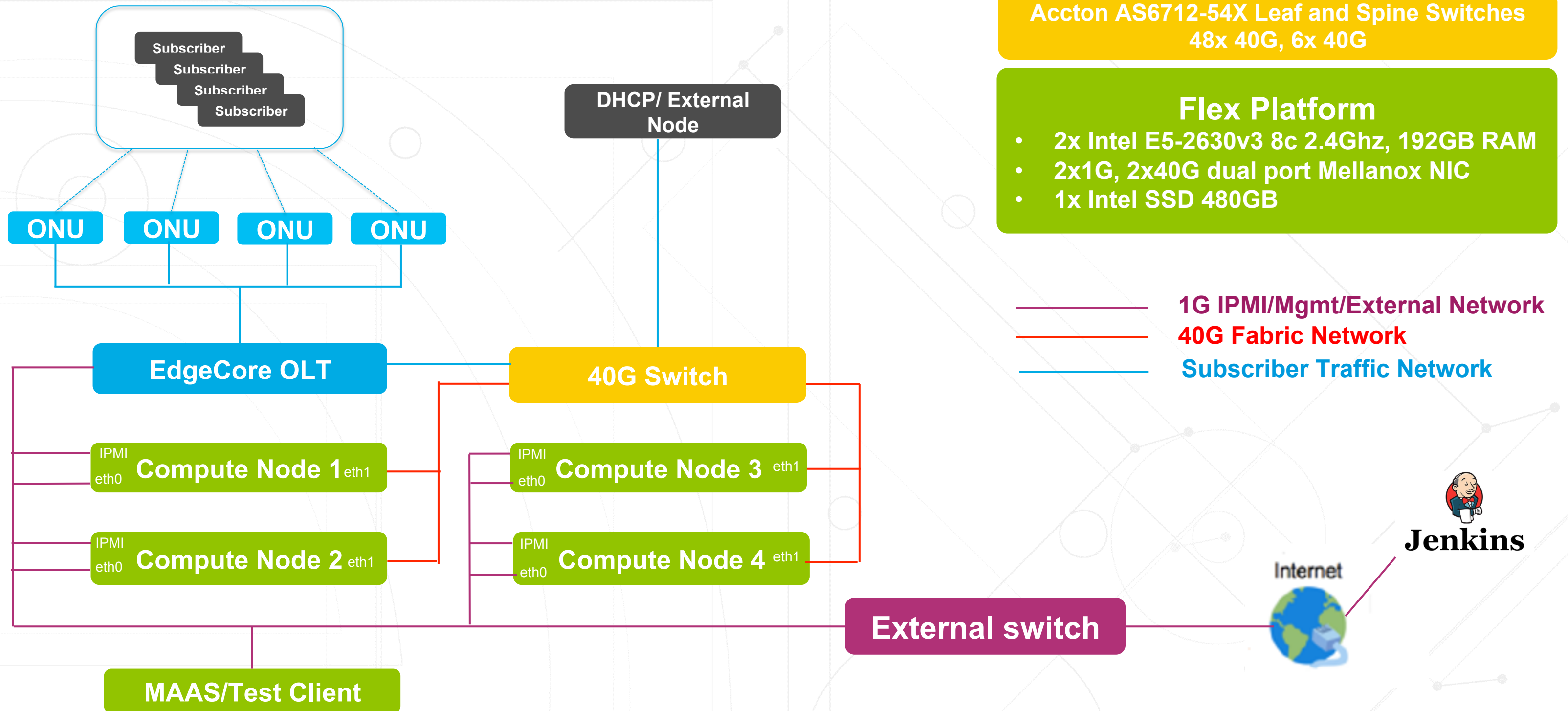
- Gateway VM instantiated on one of the compute nodes
- Abstract OLT instantiated on one of the compute nodes

## External

- BNG, DHCP Server(RG & POD), Radius Server, External OSS, Public Internet



# SEBA POD Architecture at Flex





# ONF Jenkins Nightly-Builds for Flex SEBA POD

The screenshot displays the Jenkins web interface for a pipeline named 'build\_att-workflow\_flex-pod1-olt\_master'. The page includes a navigation sidebar on the left with options like 'Back to Dashboard', 'Status', 'Changes', and 'Configure'. The main content area shows the pipeline's description, 'Recent Changes' section, and a 'Stage View' table. The 'Stage View' table provides a detailed breakdown of build stages and their durations across multiple build runs.

**Pipeline build\_att-workflow\_flex-pod1-olt\_master**  
 Nightly Kubernetes tests on flex-pod1-olt  
 Created from job-template build\_pod\_timer from ci-management/ijb/cord-test/cord-test-pipeline.yaml  
 Created by Suchitra Vemuri, suchitra@opennetworking.org  
 Copyright (c) 2017 Open Networking Foundation (ONF)

**Stage View**

Build	Parse deployment configuration file	Clean up	Install CORD Kafka	Install Logging Infrastructure	Install Monitoring Infrastructure	Install etcd-cluster	Install voltha	Install ONOS	Install xos-core	Install att-workflow	Install base-kubernetes	Reinstall OLT software	Restart OLT processes	Configure R-CORD - Fabric and whitelist	Configure R-CORD - Subscriber	Configure R-CORD - OLT
<b>Average stage times:</b> (Average full run time: ~13min 2s)	2s	40s	1min 28s	2min 28s	1min 15s	6s	33s	4s	9s	1min 56s	1min 25s	56s	1min 49s	1s	584ms	846ms
#196 Nov 29, 2018 04:19 1 commit	1s	2min 12s	1min 39s	2min 36s	1min 12s	6s	21s	3s	8s	1min 42s	1min 14s	57s	1min 56s	1s	569ms	671ms
#195 Nov 28, 2018 04:19 No Changes	3s	2min 43s	1min 25s	2min 25s	1min 13s	5s	19s	5s	7s	1min 42s	1min 15s	49s	1min 50s	1s	521ms	1s
#194 Nov 27, 2018 15:19 1 commit	2s	4s	1min 30s	2min 26s	1min 13s	6s	15s	5s	8s	1min 30s	1min 16s	49s	1min 49s	959ms	644ms	650ms
#193 Nov 27, 2018 No Changes																

# SEBA POD UI: CORD 6.0

The screenshot displays the SEBA POD UI for CORD 6.0. The browser window shows the URL `10.192.4.241:30001/#/dashboard`. The dashboard features a dark theme with a sidebar on the left containing navigation options: Home, Core, Slices, Nodes, Instances, Att workflow driver, Fabric crossconnect, Fabric, Kubernetes, Volt, Onos, and Rcord. The main content area is titled "Service Graph" and shows a network diagram with nodes: RCORD, VOLT, ONOS, FABRIC, FABRIC-CROSSCONNECT, ATT-WORKFLOW-DRIVER, and KUBERNETES. Below the graph are four summary cards: Services, Service Instances, Instances, and Networks. A "System summary:" section at the bottom provides key metrics: 0 Nodes, 54 Slices, and 0 Instances. The top right corner includes a "Service Status" dropdown menu. The bottom left corner shows the R-CORD logo and a "Logout" button.

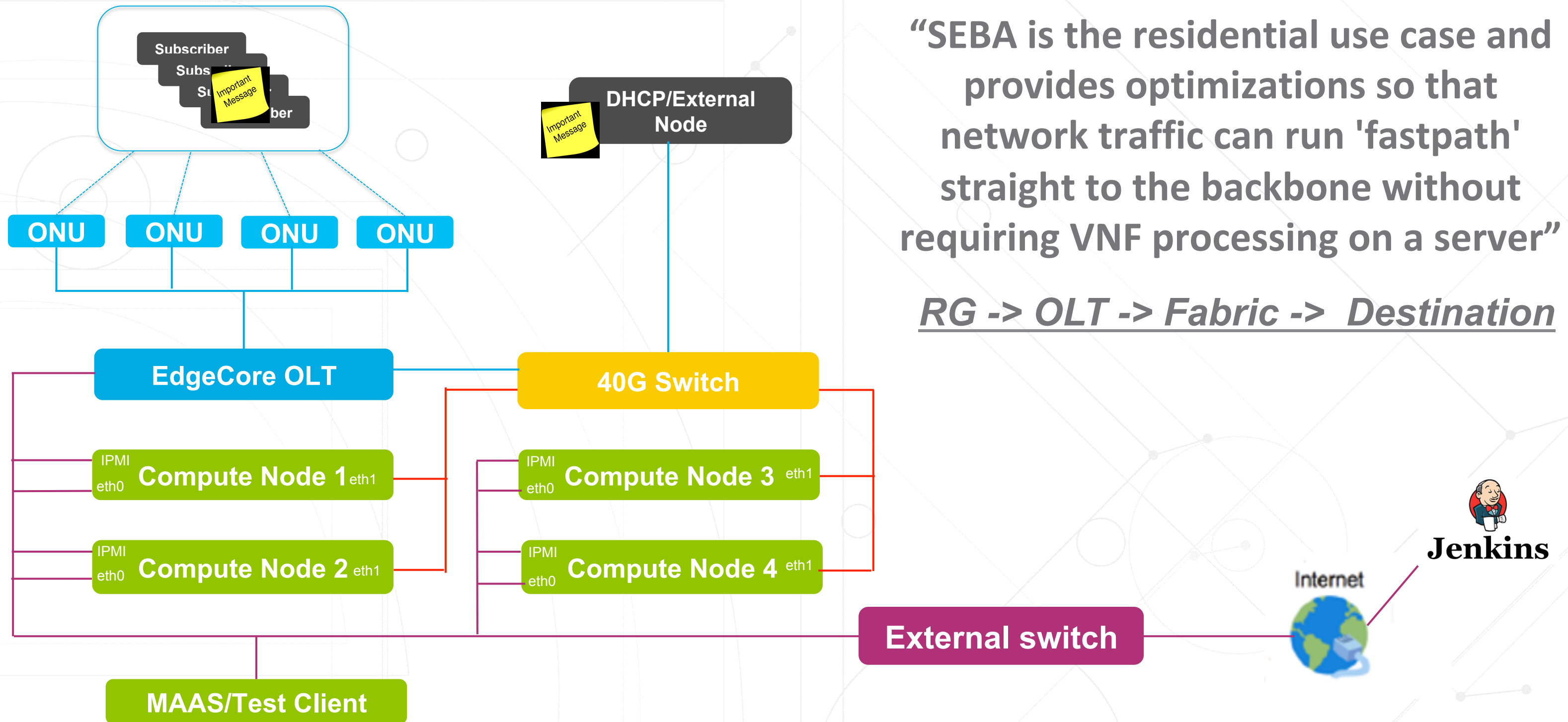
**Service Graph**

```
graph LR; RCORD --- VOLT; VOLT --- ONOS; VOLT --- FABRIC_CROSSCONNECT[FABRIC-CROSSCONNECT]; VOLT --- ATT_WORKFLOW_DRIVER[ATT-WORKFLOW-DRIVER]; ONOS --- FABRIC; ONOS --- KUBERNETES
```

**System summary:**

Category	Value
Nodes	0
Slices	54
Instances	0

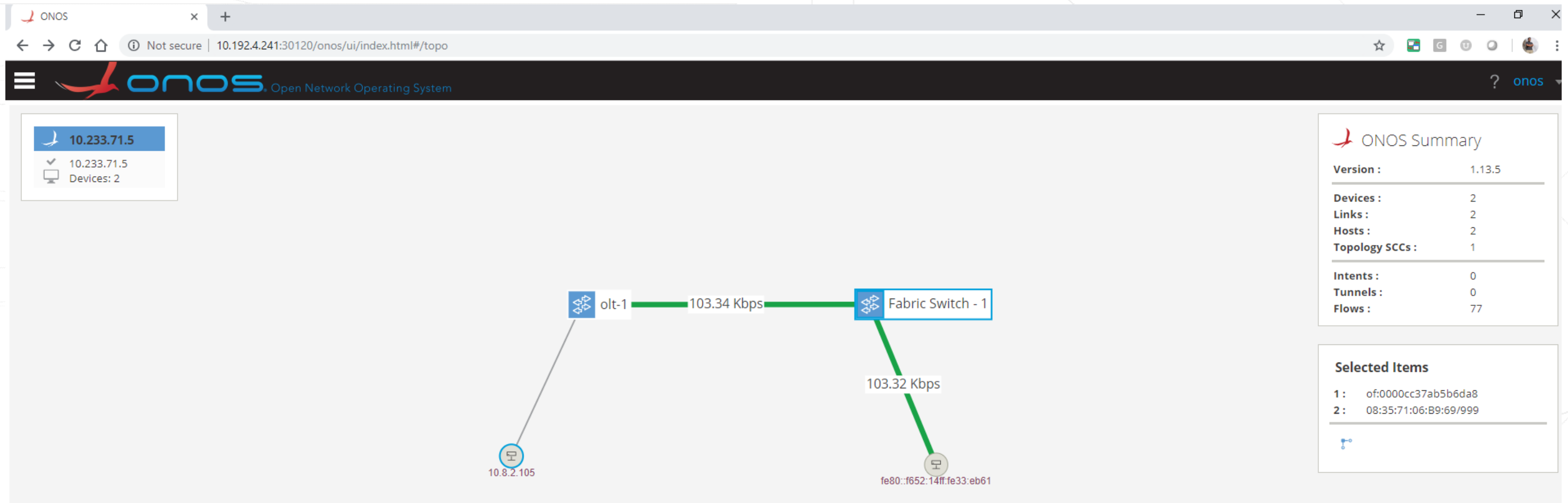
# Validate: SEBA POD 'Fastpath' Network Traffic Flow



“SEBA is the residential use case and provides optimizations so that network traffic can run 'fastpath' straight to the backbone without requiring VNF processing on a server”

RG -> OLT -> Fabric -> Destination

# 'Fastpath' Network Flow Validation on SEBA POD



RG@ubuntu:~\$ nohup ping 10.8.2.100 > ping\_log.txt &

**RG -> OLT -> Fabric -> Destination**

Onos ui: <http://10.192.4.241:30120/onos/ui/index.html#/topo> onos/rocks

# Automated SEBA Test Plan

SN	Group	Test	TestCase ID	Results Pass/Fail
test1	Verify End-end ping with ONU in Correct Location	Validates E2E Ping Connectivity and object states for the given scenario:  Configure whitelist with correct ONU location Validate successful authentication/DHCP/E2E ping	ATT_Test001	PASS
test2	Test by removing ONU from Whitelist, and re-add ONU to Whitelist for a successful ping	Validates E2E Ping Connectivity and object states for the given scenario:  Configure whitelist with correct ONU location Validate successful authentication/DHCP/E2E ping Remove ONU from whitelist Validate failed authentication/DHCP/E2E ping Add ONU to whitelist Validate successful authentication/DHCP/E2E ping	ATT_Test001	FAIL
test3	Test with ONU in Wrong Location and re-add ONU in Correct Location for a successful ping	Validates E2E Ping Connectivity and object states for the given scenario:  Configure whitelist with correct ONU location Validate successful authentication/DHCP/E2E ping Update whitelist with wrong ONU location Validate failed authentication/DHCP/E2E ping Update whitelist with correct ONU location Validate successful authentication/DHCP/E2E ping	ATT_Test001	FAIL
test4	Test by Removing Subscriber and re-creating the Subscriber for a successful ping	Validates E2E Ping Connectivity and object states for the given scenario:  Configure whitelist with correct ONU location Validate successful authentication/DHCP/E2E ping Remove subscriber model Validate successful authentication (expected with the ONF pod setup) but failed DHCP/E2E ping Recreate subscriber model Validate successful authentication/DHCP/E2E ping	ATT_Test001	PASS
test5	Test by Skipping Subscriber Provisioning and re-provisioning Subscriber	Validates E2E Ping Connectivity and object states for the given scenario:  Configure whitelist with correct ONU location and skip provisioning subscriber Validate successful authentication (expected with the ONF pod setup) but failed DHCP/E2E ping Provision subscriber Validate successful authentication/DHCP/E2E ping	ATT_Test001	PASS

# Automated SEBA Test Plan

SN	Group	Test	TestCase ID	Results Pass/Fail
test6	Test by skipping Authentication	Validates failed authentication/DHCP/E2E Ping with the following scenario:  Configure whitelist with correct ONU location and skip RG authentication Validate failed authentication/DHCP/E2E Ping	ATT_Test001	PASS
test7	Test with ONU not in Whitelist	Validates failed E2E Ping Connectivity and object states for the given scenario:  Skip whitelist configuration for ONU Validate failed authentication/DHCP/E2E ping	ATT_Test001	PASS
test8	Test with ONU not in Whitelist and by skipping Subscriber Provisioning	Validates E2E Ping Connectivity and object states for the given scenario:  Skip whitelist configuration for ONU and subscriber provisioning Validate successful authentication but failed DHCP/E2E ping Configure whitelist with correct ONU location Validate successful authentication (expected with the ONF pod setup) but failed DHCP/E2E ping Provision subscriber Validate successful authentication/DHCP/E2E ping	ATT_Test001	PASS
test9	Test with ONU in Wrong Location	Validates E2E Ping Connectivity and object states for the given scenario:  Configure whitelist with wrong ONU location Validate failed authentication/DHCP/E2E ping	ATT_Test001	PASS
test10	Test with ONU in Wrong Location and Skip Subscriber Provisioning,  Then fix ONU in Correct Location and Provision Subscriber	Validates E2E Ping Connectivity and object states for the given scenario:  Configure whitelist with wrong ONU location and skip subscriber provisioning Validate failed authentication/DHCP/E2E ping Configure whitelist with correct ONU location Validate successful authentication (expected with the ONF pod setup) but failed DHCP/E2E ping Provision subscriber Validate successful authentication/DHCP/E2E ping	ATT_Test001	PASS

# ONF Jenkins Test Automation for Flex SEBA POD

The screenshot shows the Jenkins web interface for a pipeline named 'build\_att-workflow\_flex-pod1-olt\_master\_test'. The browser address bar shows the URL: https://jenkins.opencord.org/view/ATT-Workflow/job/build\_att-workflow\_flex-pod1-olt\_master\_test/. The Jenkins logo and navigation menu are visible on the left. The main content area displays the pipeline name and a description: 'Post Tests on flex-pod1-olt triggered by build\_flex-pod1-olt\_master'. It also shows the pipeline's origin: 'Created from job-template build\_pod\_test from ci-management/jjb/cord-test/cord-test-pipeline.yaml' and the creator: 'Created by Kailash Khalasi - kailash@opennetworking.org'. A 'Recent Changes' section shows a commit on Nov 29 at 04:33. The 'Stage View' section shows a table of stage durations for build #110, with the 'Subscriber Validation and Ping Tests' stage highlighted in a blue box.

**Pipeline build\_att-workflow\_flex-pod1-olt\_master\_test**

Post Tests on flex-pod1-olt triggered by build\_flex-pod1-olt\_master

Created from job-template build\_pod\_test from ci-management/jjb/cord-test/cord-test-pipeline.yaml  
Created by Kailash Khalasi - kailash@opennetworking.org  
Copyright (c) 2017 Open Networking Foundation (ONF)

[Recent Changes](#)

**Stage View**

Average stage times:

Stage	Average Stage Time	Current Build Time
Parse deployment configuration file	2s	2s
Download Cord-Tester Repo	10s	10s
Test Configurations	525ms	525ms
<b>Subscriber Validation and Ping Tests</b>	1h 1min	1h 1min
Publish test results	19s	19s

# Flex SEBA POD: Test Summary

## ATT Test001 Test Report

Generated  
20181128 14:07:42 GMT-08:00  
1 day 2 hours ago

### Summary Information

**Status:** 2 critical tests failed  
**Documentation:** Test various end-to-end scenarios with ATT workflow  
**Start Time:** 20181128 13:19:07.911  
**End Time:** 20181128 14:07:29.210  
**Elapsed Time:** 00:48:21.299  
**Log File:** [log-ATT\\_Test001-20181128-140729.html](#)

### Test Statistics

Total Statistics	Total	Pass	Fail	Elapsed	Pass / Fail
Critical Tests	10	8	2	00:48:20	
All Tests	10	8	2	00:48:20	

Statistics by Tag	Total	Pass	Fail	Elapsed	Pass / Fail
test1	1	1	0	00:03:04	
test10	1	1	0	00:05:46	
test2	1	0	1	00:08:52	
test3	1	0	1	00:01:54	
test4	1	1	0	00:05:22	
test5	1	1	0	00:04:35	
test6	1	1	0	00:04:00	
test7	1	1	0	00:04:09	
test8	1	1	0	00:06:26	
test9	1	1	0	00:04:13	

Statistics by Suite	Total	Pass	Fail	Elapsed	Pass / Fail
ATT Test001	10	8	2	00:48:21	



# Flex SEBA POD: Test Execution Log

## Test Execution Log

**SUITE** ATT Test001

Full Name: ATT Test001

Documentation: Test various end-to-end scenarios with ATT workflow

Source: [/var/jenkins/workspace/build\\_att-workflow\\_flex-pod1-olt\\_master\\_test/cord-tester/src/test/cord-api/Tests/WorkflowValidations/ATT\\_Test001.robot](/var/jenkins/workspace/build_att-workflow_flex-pod1-olt_master_test/cord-tester/src/test/cord-api/Tests/WorkflowValidations/ATT_Test001.robot)

Start / End / Elapsed: 20181128 13:19:07.911 / 20181128 14:07:29.210 / 00:48:21.299

Status: 10 critical test, 8 passed, **2 failed**  
10 test total, 8 passed, **2 failed**

- + **SETUP** Setup Suite
- + **TEARDOWN** Teardown Suite
- + **TEST** ONU in Correct Location
- + **TEST** ONU in Correct Location -> Remove ONU from Whitelist -> Add ONU to Whitelist
- + **TEST** ONU in Correct Location -> ONU in Wrong Location -> ONU in Correct Location
- + **TEST** ONU in Correct Location -> Remove Subscriber -> Create Subscriber
- + **TEST** ONU in Correct Location (Skip Subscriber Provisioning) -> Provision Subscriber
- + **TEST** ONU in Correct Location (Skip Authentication)
- + **TEST** ONU not in Whitelist
- + **TEST** ONU not in Whitelist (Skip Subscriber Provisioning) -> Add ONU to Whitelist -> Provision Subscriber
- + **TEST** ONU in Wrong Location
- + **TEST** ONU in Wrong Location (Skip Subscriber Provisioning) -> ONU in Correct Location -> Provision Subscriber

# Demo

- **Subscriber node: cluser@10.192.4.61**

```
nohup ping 10.8.2.100 > ping_log.txt &
```

- **DHCP node: cord@10.192.4.62**

```
sudo tcpdump -eni ens3>tcpdump.txt (service tags)
```

- **ONOS UI: http://10.192.4.241:30120/onos/ui/index.html#/topo onos/rocks**

- **CORD UI: http://10.192.4.241:30001/#/dashboard**

- **Jenkins: https://jenkins.opencord.org/view/ATT-Workflow/job/build\_att-workflow\_flex-pod1-olt\_master/**

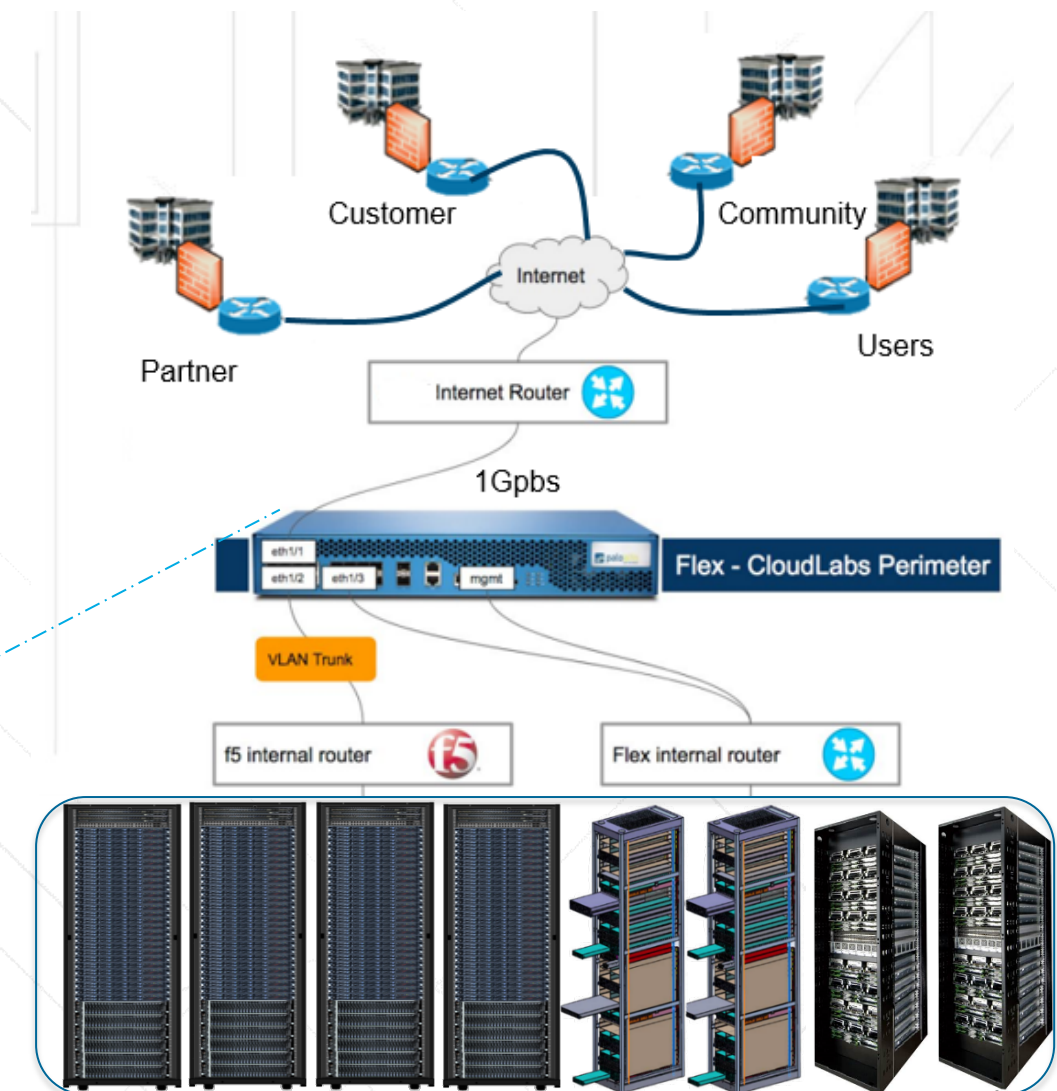
- **Test Results:**

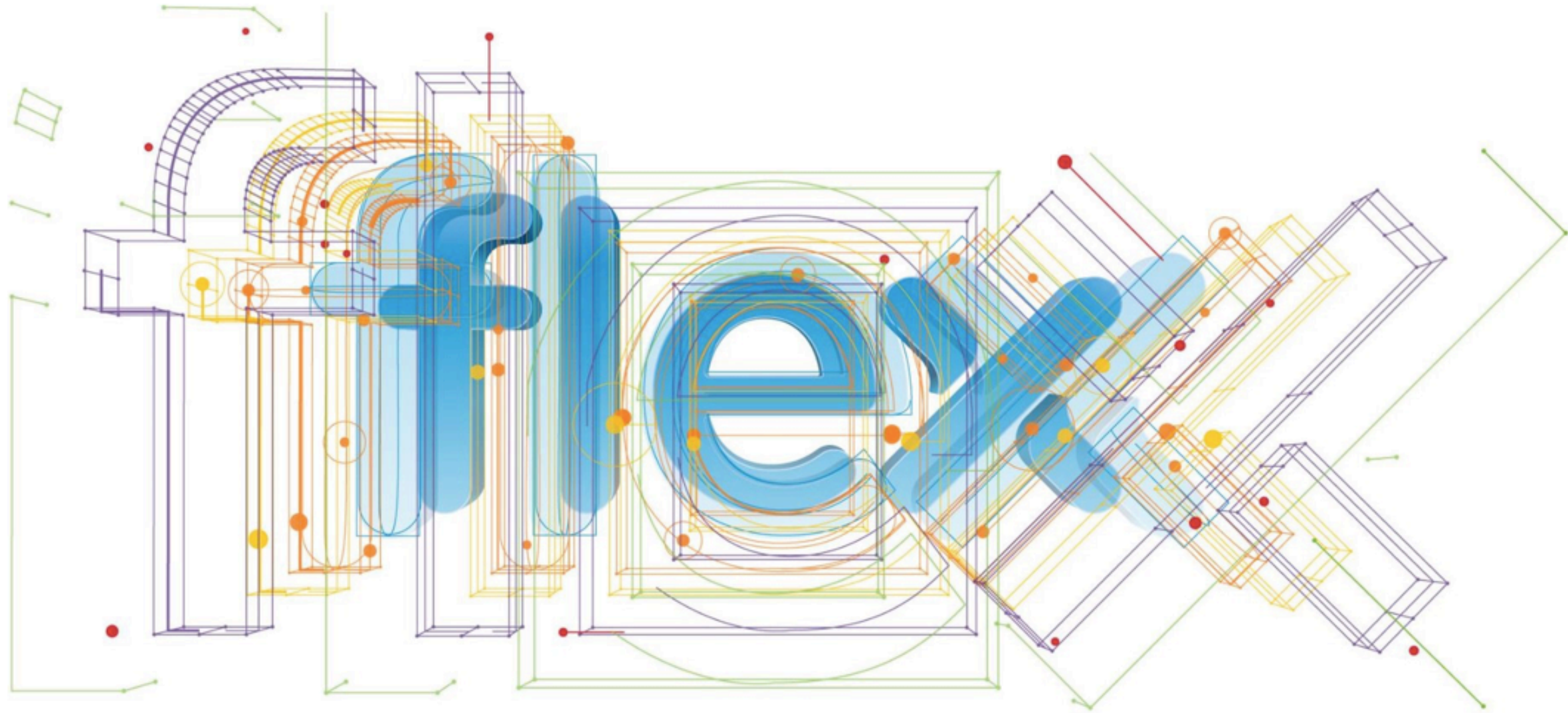
[https://jenkins.opencord.org/view/ATT-Workflow/job/build\\_att-workflow\\_flex-pod1-olt\\_master\\_test/](https://jenkins.opencord.org/view/ATT-Workflow/job/build_att-workflow_flex-pod1-olt_master_test/)

# Summary and Next Steps

## Customer, Partner and Community Engagement Lab

- Continue working on comprehensive plan to test, validate and certify CORD platform and components using Flex SEBA POD
- Continue collaborating with ONF Certification Brigade to define CORD Certification program (CCP) and its execution
- Extend in house automated test and validation framework to validate CORD platform and components with Flex SEBA POD
- Collaborate with Vendors & Service Providers to demonstrate Telco use-cases and support CORD deployments





**Thank You!**

For collaboration and questions please send email to [Siddharth.Gogar@flex.com](mailto:Siddharth.Gogar@flex.com)