

Common NFVI Telco Taskforce Antwerp Face-To-Face Sessions

Fu Qiao, China Mobile
Mark Shostak, AT&T
Mike Fix, AT&T
Lincoln Lavoie, UNH-IOL

Test & Validation

September 2019

 THE **LINUX** FOUNDATION



Discussion Outline

CVC Overview

- Structure within LFN
- Philosophy & Terms
- OVP Roadmap & Deliverables

CNTT Relationship with CVC, OPNFV, and OVP

Chapter 8 Team

- North Star & Scope
- Team Progress & Table of Contents

Methodology & Goals

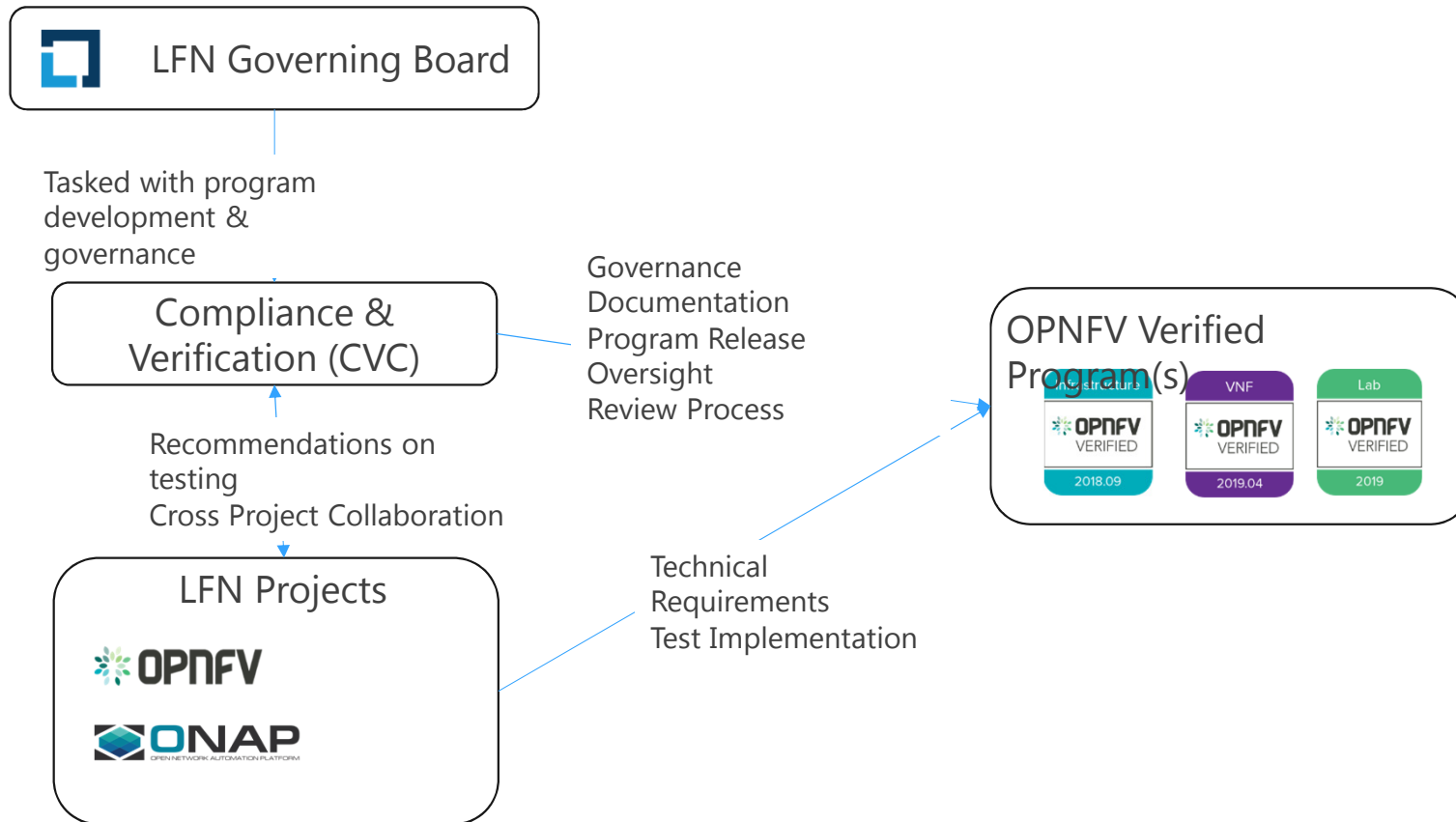
OVP ETE Framework (Intake & Requirements)

Entrance & Exit Criteria

Test Category/Case Gap Review



CVC Structure Within LFN



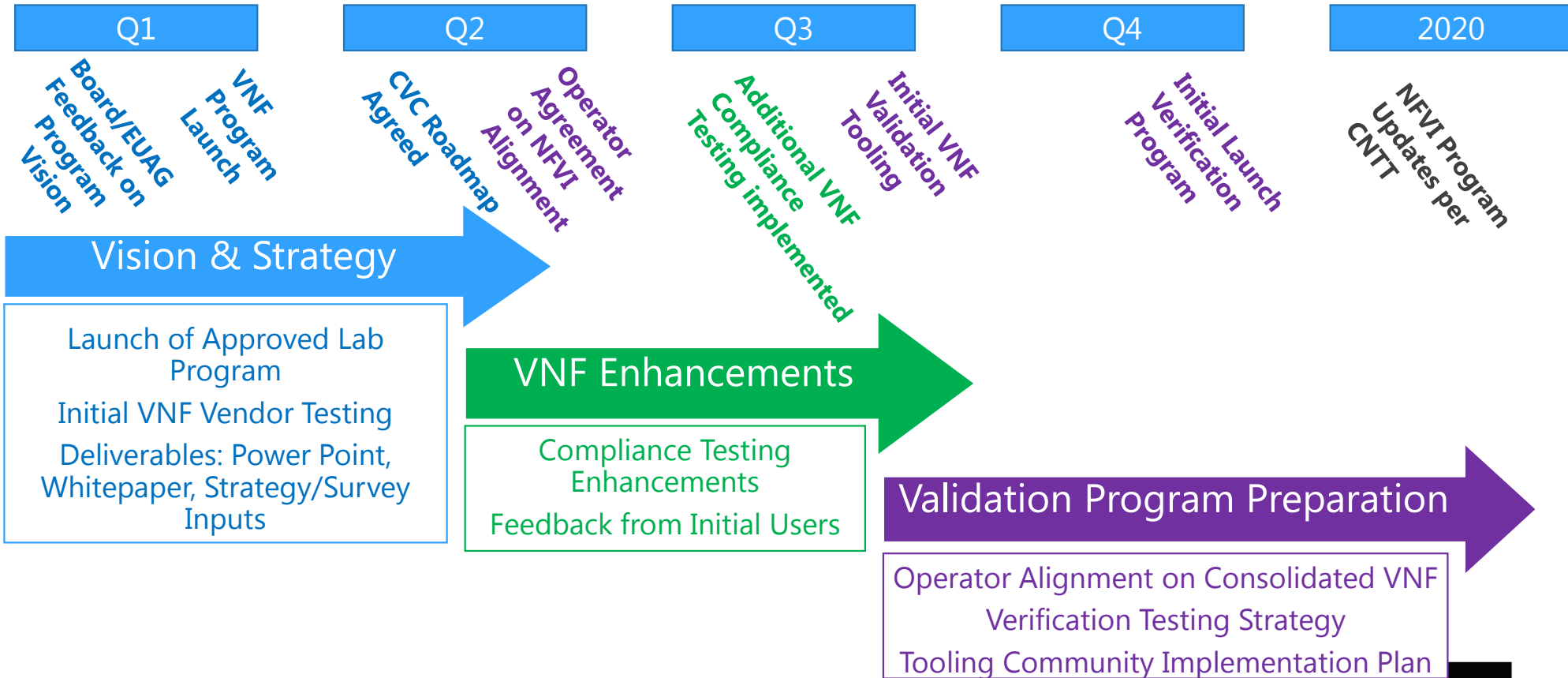
Program Philosophy

- › Open program, well aligned with open source best practices
 - › Support self-testing and 3rd party lab testing
- › Reliance on community review processes
 - › Requirements, Test Implementation, and Results
- › Uniform approach across projects
 - › Single release schedule for badges / updates
 - › Consistent definition of test types and badges

Some Terms

- › Compliance – Testing to ensure product meets requirements defined by the project
 - › API testing for correct implementation, format, responses, etc.
 - › VNF Template testing per requirements defined by ONAP
- › Validation – Testing to ensure product operation meets requirements
 - › Testing of API control over the larger system, i.e. use API to create network with expected access controls, etc.
- › Performance – Testing to measure the capability of the product
 - › Testing of traffic throughput on a VNF to meet a minimum requirement
 - › Testing the minimum number of sessions supported by a VNF
- › Should we consider formalizing additional terms?
 - › Stability, on-boarding, interoperability, etc.

OVP Roadmap (2019)



Program Deliverables & Components

- › Test Requirements
- › Test Definitions & Implementation
- › End User Documentation
- › Updates to OVP Portal
- › Beta Testing

OPNFV Verification Program (OVP) - NFVI Portal

OVP verifies products and services with the "OPNFV Verified" mark.

The OPNFV Verification Program (OVP) is an open source, community-led compliance and verification program to demonstrate the readiness and availability of commercial NFV products and services, including NFVI and VNFs, using OPNFV and CNFV components. The program is the first of its kind to combine automated compliance and verification testing for multiple parts of the NFV stack and address Communication Service Providers (CSPs) and vendors to establish baseline conformance and interoperability. Participants can test in-house or with neutral, designated labs.

This portal is for testing products and services relating to NFV Infrastructure (NFVI) only. For testing Virtual Network Functions (VNFs), visit the [OPNFV Verification Program \(OVP\) portal](#).

Get Started

- Visit the [OPNFV Verification Program \(OVP\) page](#) for more information
- From the home page, Submit the Participation Form
- Follow the step-by-step instructions in the [OVP Workflow](#)
- Use this portal to upload your NFVI test results when ready


Please send any questions to verified@opnfv.org.

OPNFV Verified Products Directory (NFVI)

Company	Product	Category	Version
Lenovo	Lenovo Select Solution for NFVI with Wind River Titanium Cloud	Infrastructure	2018.09
Wind River	Titanium Cloud	Infrastructure	2018.09
NOKIA	Nokia Edge Cloud NFVI	Infrastructure	2018.09
ENEA	Enea NFV Core 1.1	Infrastructure	2018.09
LG U+	U-Stack Cloud	Infrastructure	2018.01
ERICSSON	Ericsson Cloud Execution Environment (CEE)	Infrastructure	2018.01
NOKIA	Nokia AirFrame Cloud Infrastructure for Real-time applications (RCRI)	Infrastructure	2018.01
Wind River	Titanium Cloud	Infrastructure	2018.01
HUAWEI	FusionSphere Cloud Operating System	Infrastructure	2018.01
ZTE	TECS Cloud OS	Infrastructure	2018.01
NOKIA	Nokia AirFrame Data Center Solution	Infrastructure	2018.01

Relationship with CVC

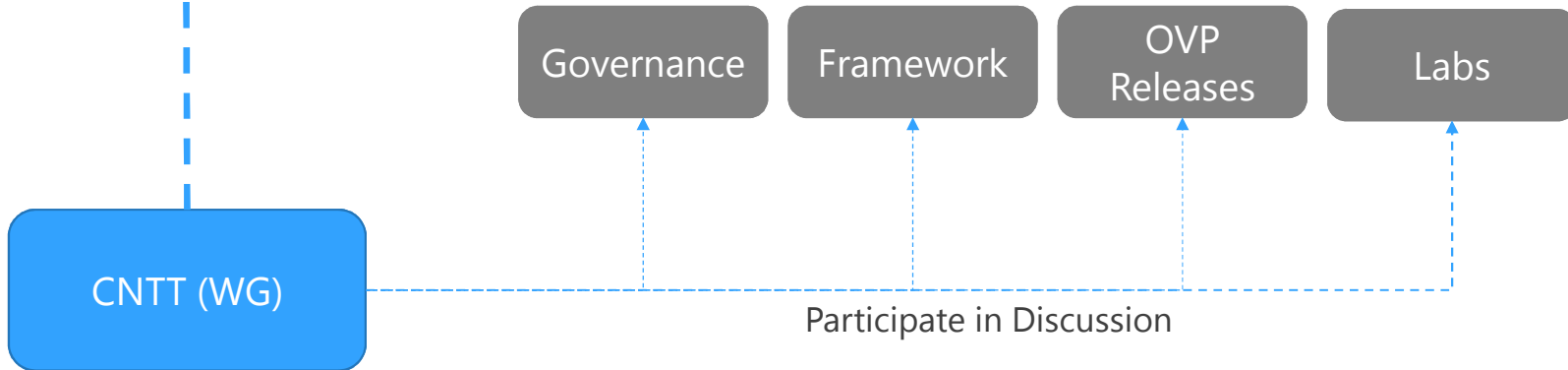


 Lincoln Lavoie



What do we expect from CVC?

- Certification process and life-cycle.
- OVP E2E Framework Creation (NFVI + VNF).
- OVP Releases and timelines.
- Intake and Onboard for Lab management.



- CNTT will work directly with CVC to align with governance
- Output of CNTT will be input to release scope, labs needs, and augment governance where needed

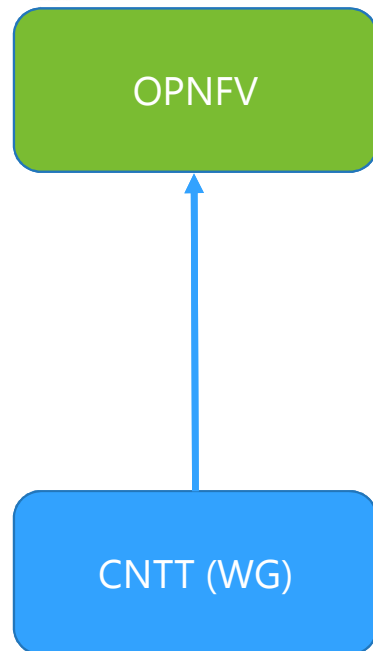




Relationship with OPNFV and OVP

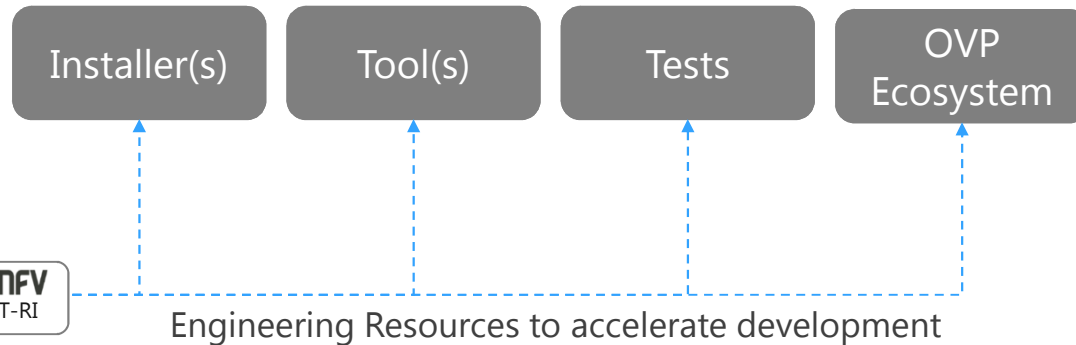


Bin Hu



What do we expect from OPNFV?

- Installers to install NFVI with a state aligned with CNTT RM, RA.
- Test tools to test NFVI (against a given state) and VNFs.
- Provide test scripts to cover tests cases of CNTT interest.
- Leverage OVP Ecosystem for labs and certification.



- CNTT will work directly with OPNFV via the RI Project
- Output of CNTT-RI will be RI requirements and test cases



Chapter 8 Team: North Star



Mission

Ensure Implementation of CNTT Reference Model and Reference Architecture meets industry driven quality assurance standards for compliance, verification and validation.

Objectives

- **Data Driven** RA Verification and Validations
- **OPNFV, CVC, and OVP Processes used** to onboard and check for NFVI compliance
- **Entry** and **Exit** Quality **Standards** are satisfied
- Ensure **test harnesses** can be **ported** and utilized **across multiple distributions**

Guiding Tenets

- **Verification** and **Validations** determine NFVI+VNF compliance
- **Verification** signals conformance to design requirement specifications
- **Validations** signals compliance that output of a product meets the expected, or desired outcome
- **Certifications**, are out of scope as this measures adherence to development, however, no code is being delivered by testing
- OVP and CVC track and govern RM/RA verification

Scope



Scope & Test Strategy

- **Manifest Verifications** verify NFVI matches hardware and software profile specifications for RM/RA
- **Empirical Validations** baseline NFVI and Ref/Golden VNFs behaviors for future comparison
- **Interoperability Validation** performed leveraging VVP/CVC test suites to ensure VNF can be spun up, modified, or removed, on the target NFVI

Not In Scope

- VNF functional testing
- ONAP as a MANO for VNFs
- Validating VNF's ability to be upgraded
- Georedundant and Load Testing

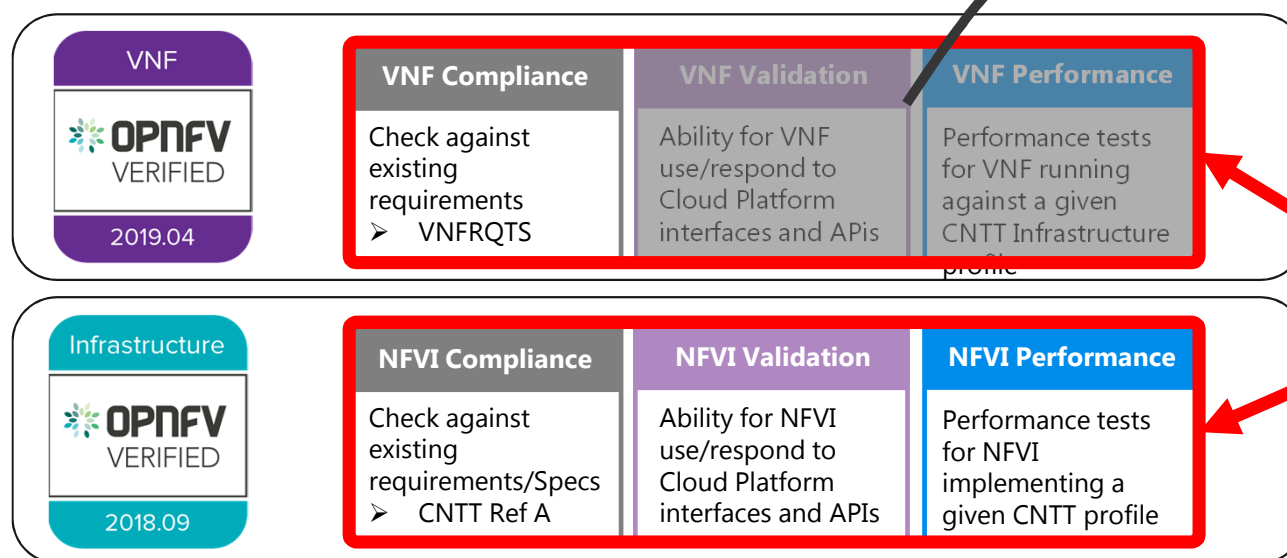
Different Distributions

Repeat the strategy of Manifest Verification, Empirical Golden VNF Validations, and Interoperability Testing for any new Distributions.

Verification & Validation Scope



Requires more discussion for a different time



Areas of Impact of CNTT

Example Tests

- VNF Interoperability Testing
- Security Testing
- Scalability Testing
- Fault Recovery Testing
- VNF Coexistence
- HA Testing

Team Progress

9/19/2019



TC Gap Assessment

- ✓ Deep-dive of OPNFV, CVC, and OVP Process
- ✓ Initial pass assessing Key Active OPNFV Projects for CNTT alignment
- ✓ Normalize TC Review results format
- ◐ PTLs provide Test Suite data
- ✓ Initial Test Category/Case Review

Partnerships & Communications

- ✓ Stakeholder Verizon as co-author of Verification Process
- ✓ Launch PR Campaign with the OPNFV TSC and CVC
- ◐ Continued CNTT>OPNFV>CVC alignment discussions
- ✓ OPNFV Proposal Review 9/9-9/16
- ✓ OPNFV TSC Project Vote 9/17



Setup Lab

- ◐ Finalize RM/RA/RI requirements
- ✓ Identify initial lab hardware needs
- ⚠ Configure SUT, & Execute Sanity
- ⚠ Identify and Close Gaps in TCs

THE **LINUX** FOUNDATION

MF



Documentation

- ✓ Outline & Initial Merge Complete
- ◐ Working GitHub Issues
- ◐ Define & vet Verification Methodology
- ◐ Create Annex, Developing Content
- ⚠ Finalize Ch 8 Content & Publish
- ⚠ Finalize RI Content



Chapter 8 - Table of Contents



Synopsis

- ✓ **Introduction** - Overview, problem statement, scope
- ✓ **Principles and Guidelines** – Details on objectives, verification methodologies, and governance
- ✓ **Terms and Resources** – Common terms and external documentation



Process & Management

- 📅 **Lifecycle and Process Flow** – Project management guidelines, onboarding, SLAs and Issue Resolution
- ✓ **Current OVP/CVC Process** – Existing process, test frameworks, tools, test cases/scenarios and test certification guidelines

Verification & Validation Strategy

- 📅 **CNTT/NFVI Validation Approach** – Augmented OPNFV and OVP certification process using NFVI Verification, Empirical Validation, and VNF Interoperability Validation
- 📅 **Quality Assurance** – Dependencies, Recommendations, Assumptions, System Under Test (SUT) pre-reqs for certification, Entrance/Exit Criteria, Test Frameworks, Categories, Harness(es), and Tools
- 📅 **Test Results** – Metrics, Measurements, and Respective Certifications and Badges – e.g. pass/fail, measure only, etc

Forward Looking

- ⚠️ **Future Planning** – Additional considerations, documentation, lab mgmt, tools, or test strategies (GeoRed, DR)
- ⚠️ **Recommendations** – Best practices (placeholder) after initial implementation of RA#1

Methodology & Goals



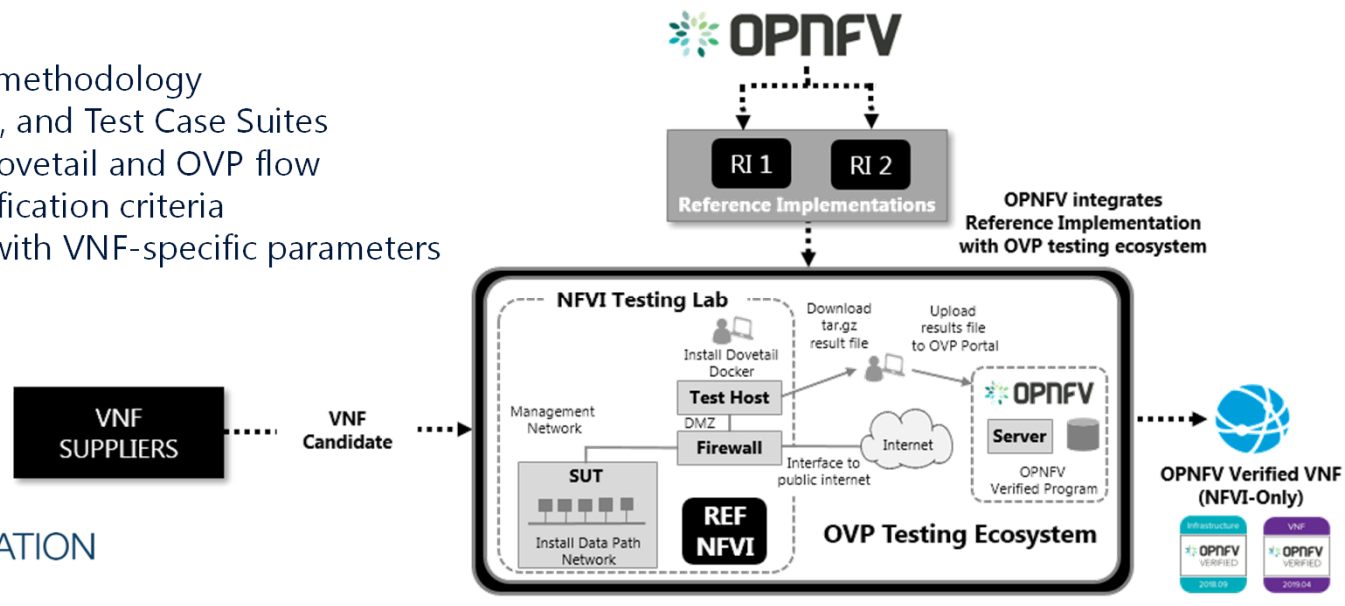
Methodology: Perform NFVI validations using CNTT reference architecture, leveraging upstream projects to define features/capabilities, test scenarios, and test cases, to be executed via the OVP Ecosystem.

OVP/CVC Validation Strategy & Vehicle:

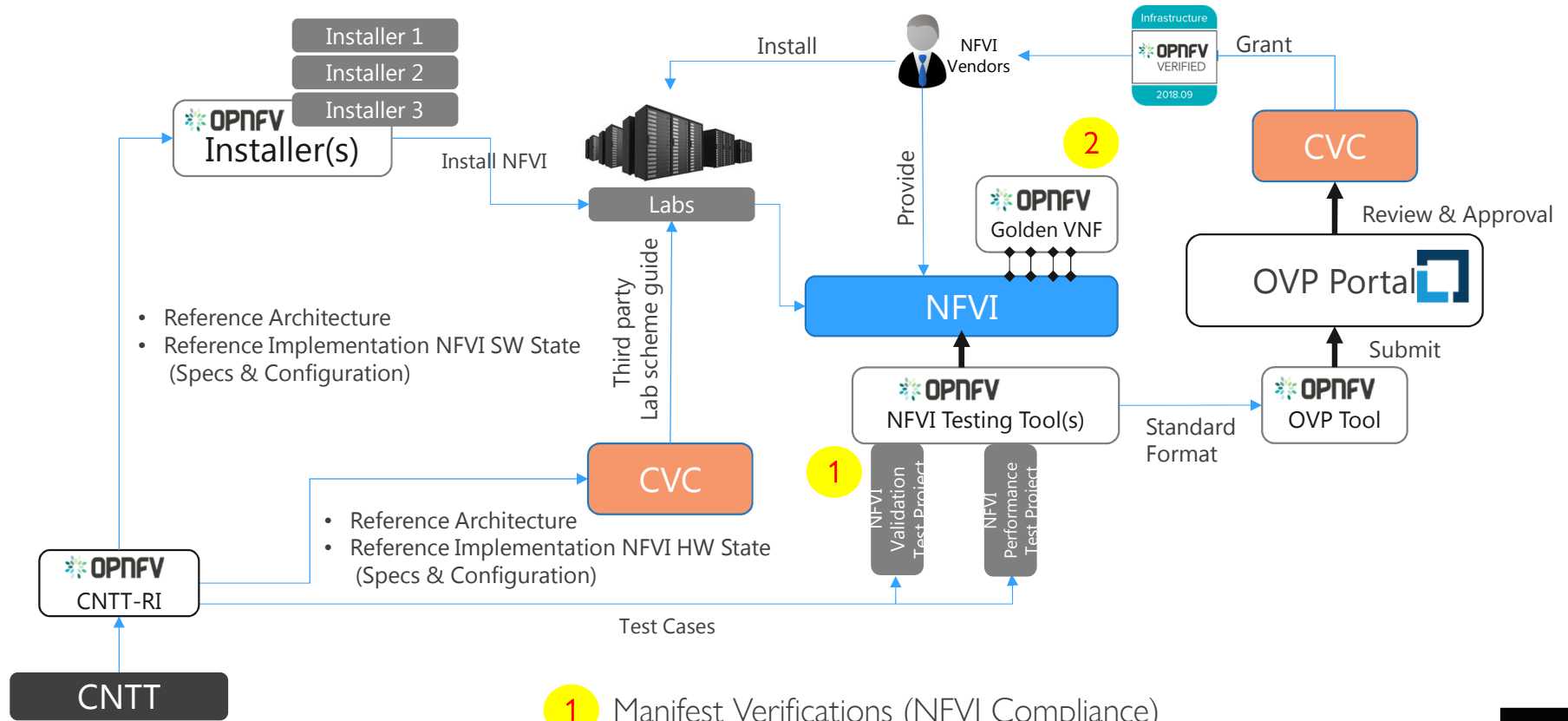
- **NFVI Verification (Compliance):** NFVI is the SUT, ensuring NFVI is compliant with specs of RM and RA
- **Empirical Validation with Reference VNF (Validation):** NFVI is the SUT, ensuring NFVI runs with Golden VNFs
- **Candidate VNF Validation (Validation & Performance):** VNF is the SUT, ensuring VNFs operate with RM and RA
- **Security:** Ensures VNF is free from known security vulnerabilities, utilizing industry standard cyber security frameworks

Best Practices:

- Standardized test methodology
- Standard Test Plan, and Test Case Suites
- Integration with Dovetail and OVP flow
- Standardized certification criteria
- Leverage models with VNF-specific parameters



OVP Framework – NFVI Validation



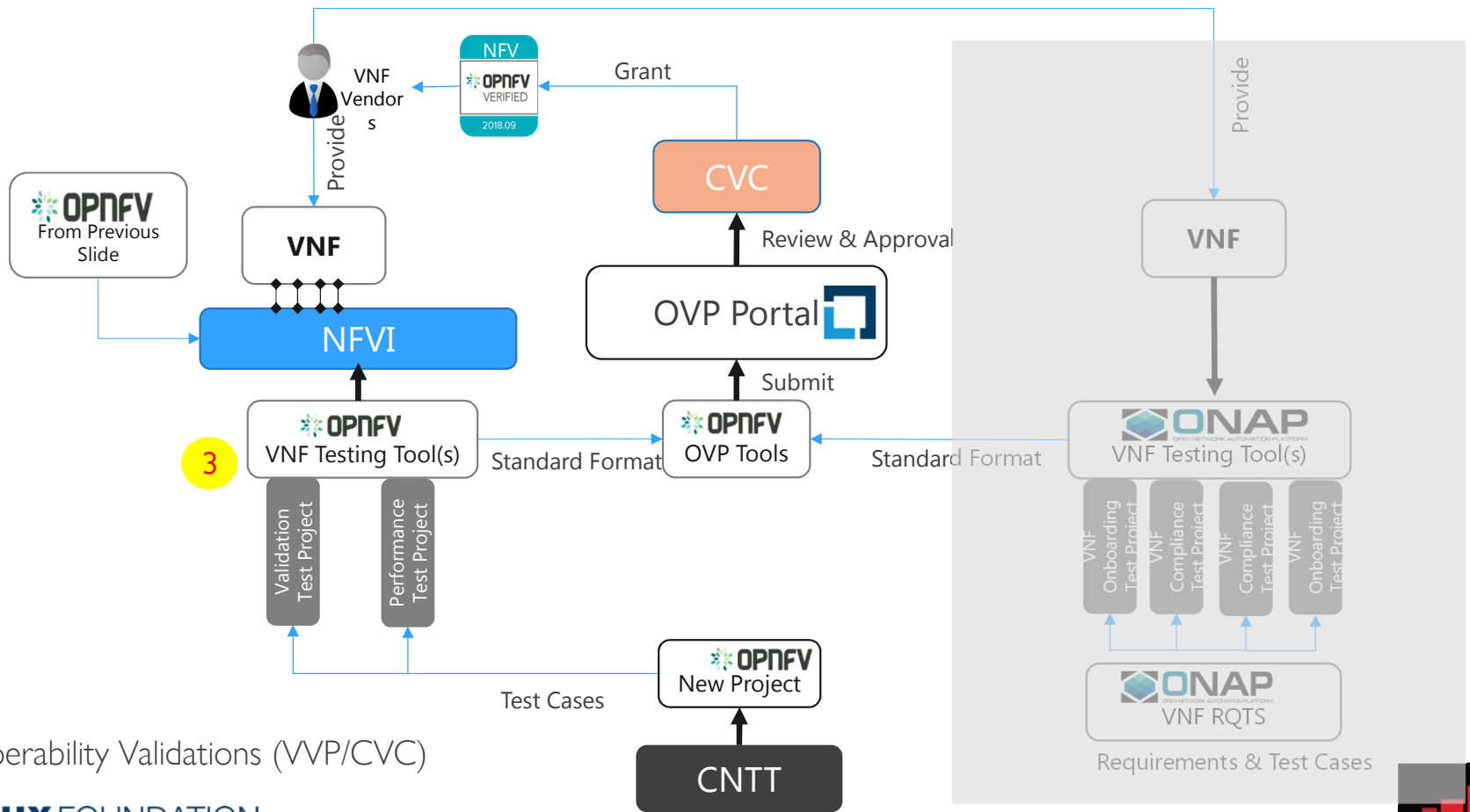
- Reference Architecture
- Reference Implementation NFVI SW State (Specs & Configuration)

- Reference Architecture
- Reference Implementation NFVI HW State (Specs & Configuration)

- 1 Manifest Verifications (NFVI Compliance)
- 2 Empirical/Baseline Validations (NFVI Compliance)



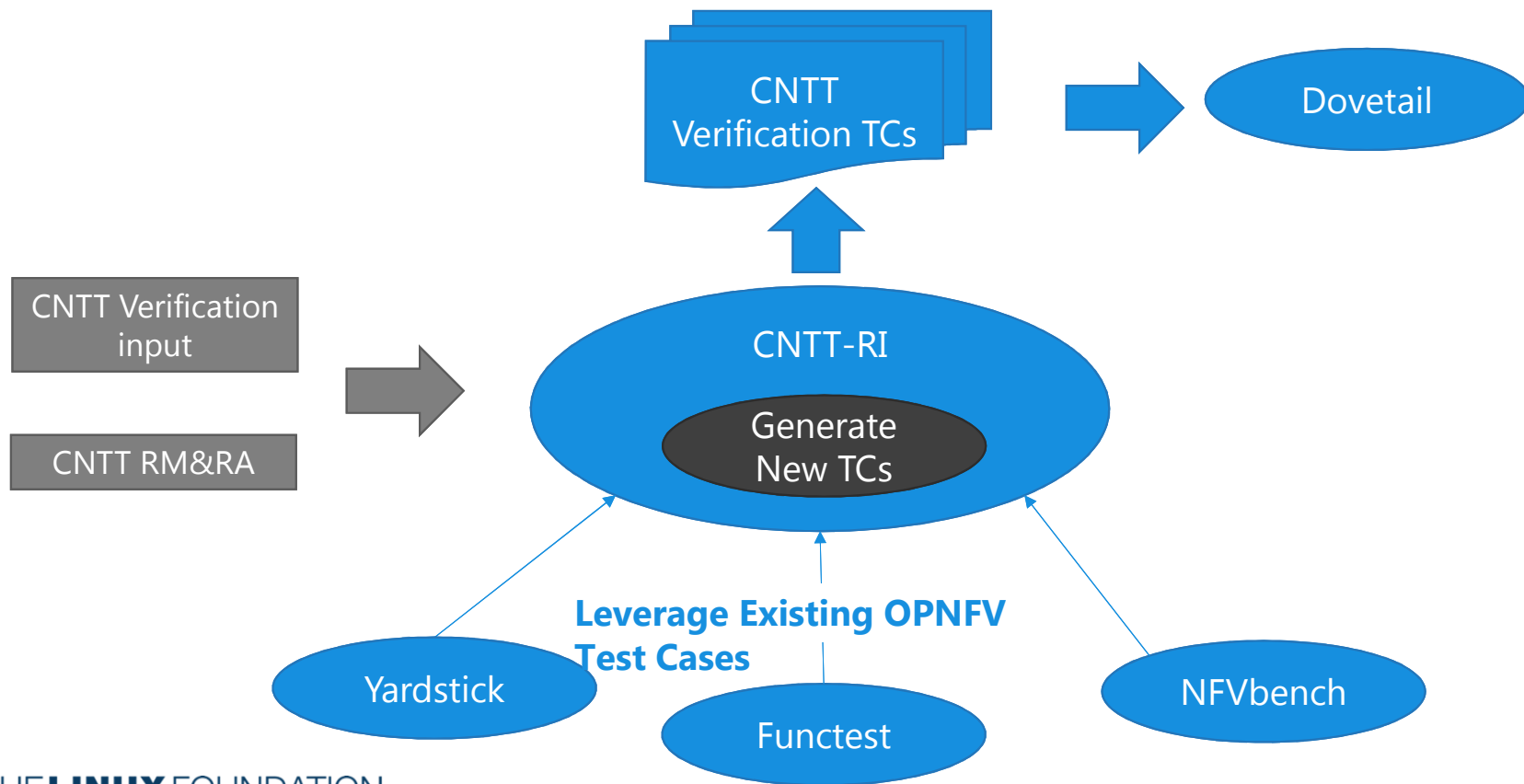
OVP Framework – NFVI+VNF Validation



3 Interoperability Validations (VVP/CVC)



Enhance Intake into OVP Framework



OPNFV/OVP Entry & Exit Criteria



Prior to Testing – VNF Supplier Provided

*OPNFV Entrance criteria must be satisfied **before testing starts**.
This demonstrates implementation of CNTT Reference Architecture.*

Entrance Criteria

- **Design Details Provided**
 - High/Low Level Design (Config, Features)
- **Environment** (document, secured, connected)
- **Test Requirements**
 - Testing schedule
 - Completed security review
 - Test owners documented
- **Test assets available**
 - Images, configurations, templates, etc
- Additional vendor-specific test cases documented & supplied

Prior to Telco Handoff – VNF Supplier Verified

*OVP Exit criteria must be satisfied to receive CVC Validation Badges.
Validation demonstrates adherence to CNTT NFVI Quality Standards.*

Exit Criteria

- **All test cases have a valid status**
- **No outstanding high severity issues**
- Known defects and outstanding issues are clearly documented
- **Operationally Stable and Functional**
 - API end-points reachable/working
 - Standard Images present, and operational
 - Snapshots and backups working
 - NFV migration is confirmed working
- **Documentation is available**
 - Deploy, config, admin, user, API guides
 - Release notes



Test Category / Case Gap Summary



Projects Identified

* Airship Installer	* High Availability
Barometer	NFVBench
Bottlenecks	* Pharos
Doctor	SampleVNF
* Dovetail	VSPerf
* Fuel	Yardstick
FuncTest	

- # Total OPNFV Projects = 31
- # CNTT-NFVI = 13 (potential value)
- # 5/13 NA for Review – *Already Covered by Yardstick and Functest

Results

- # 6 Projects can be adopted (as is)
- # 4 We can add/augment TCs for gaps
- # 3 Create projects for new testing

 THE **LINUX** FOUNDATION

MF

Assessment Strategy

- Select Project by activity, use, and maturity state
- Compare Against Test Categories
- Identify Gaps
- Form Professional Opinion – e.g. augment, adopt
- **Solicit Strategic Partner Contributions**

Test Categories

- **(Hardware Validations)** BareMetal – HW & O/S validations
- **(Component Validation and VNF Validation Config Only)** VNF Interoperability – validations
- **(Platform Stability)** Compute Component – validations
- **(Platform Resiliency)** Control Plane Component – validations

Next Steps

- **Review Projects** Identified during Antwerp not considered
- **Integrate TCs** from these projects into the delivery stream
- **Discuss augmenting existing test projects**, or create new
- **Onboard Spirent Test Case contributions – Where?**
- **Finalize** Test-/Use- Case Needs



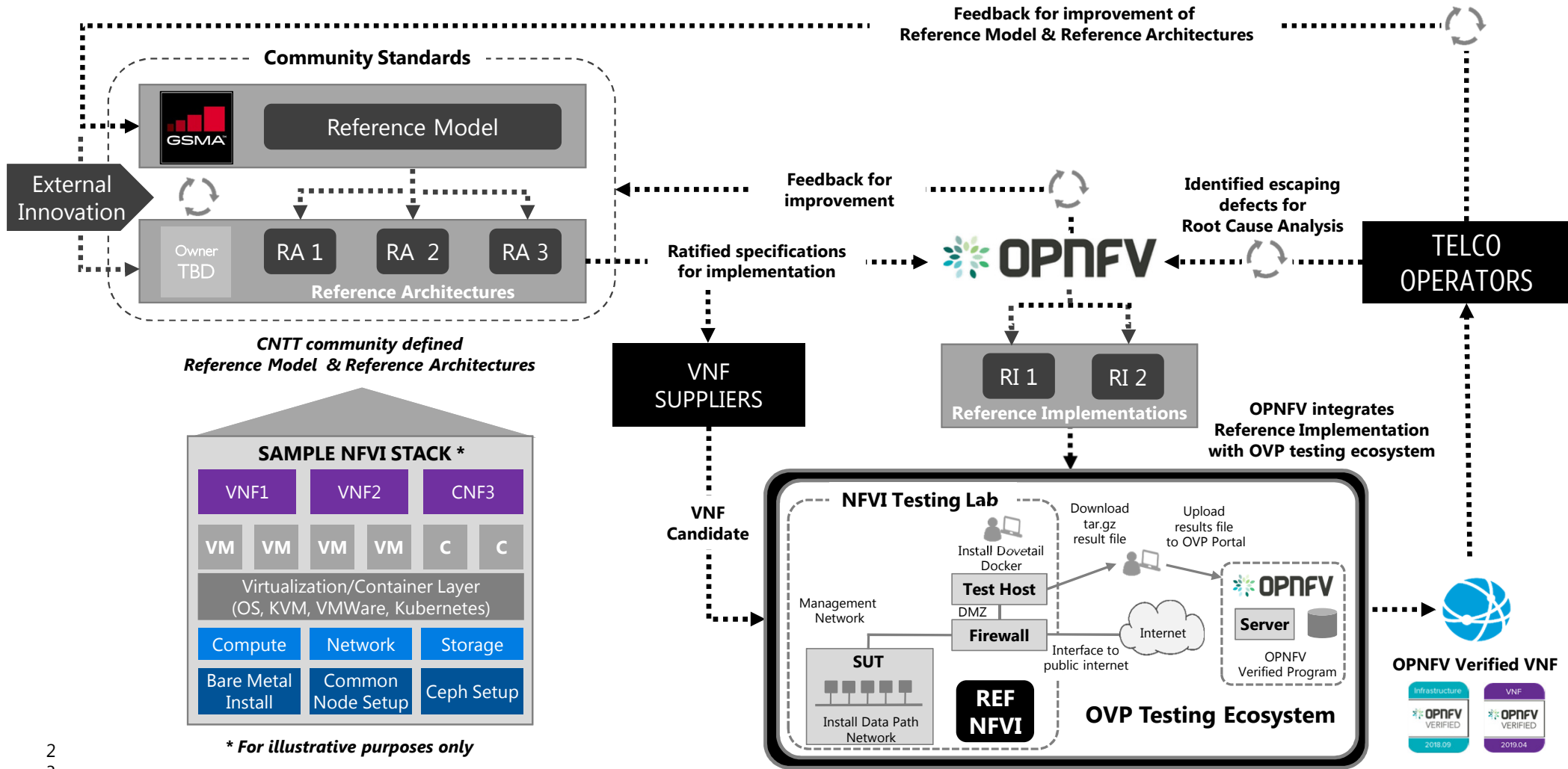
Test Category / Case Gap Summary.. Continued



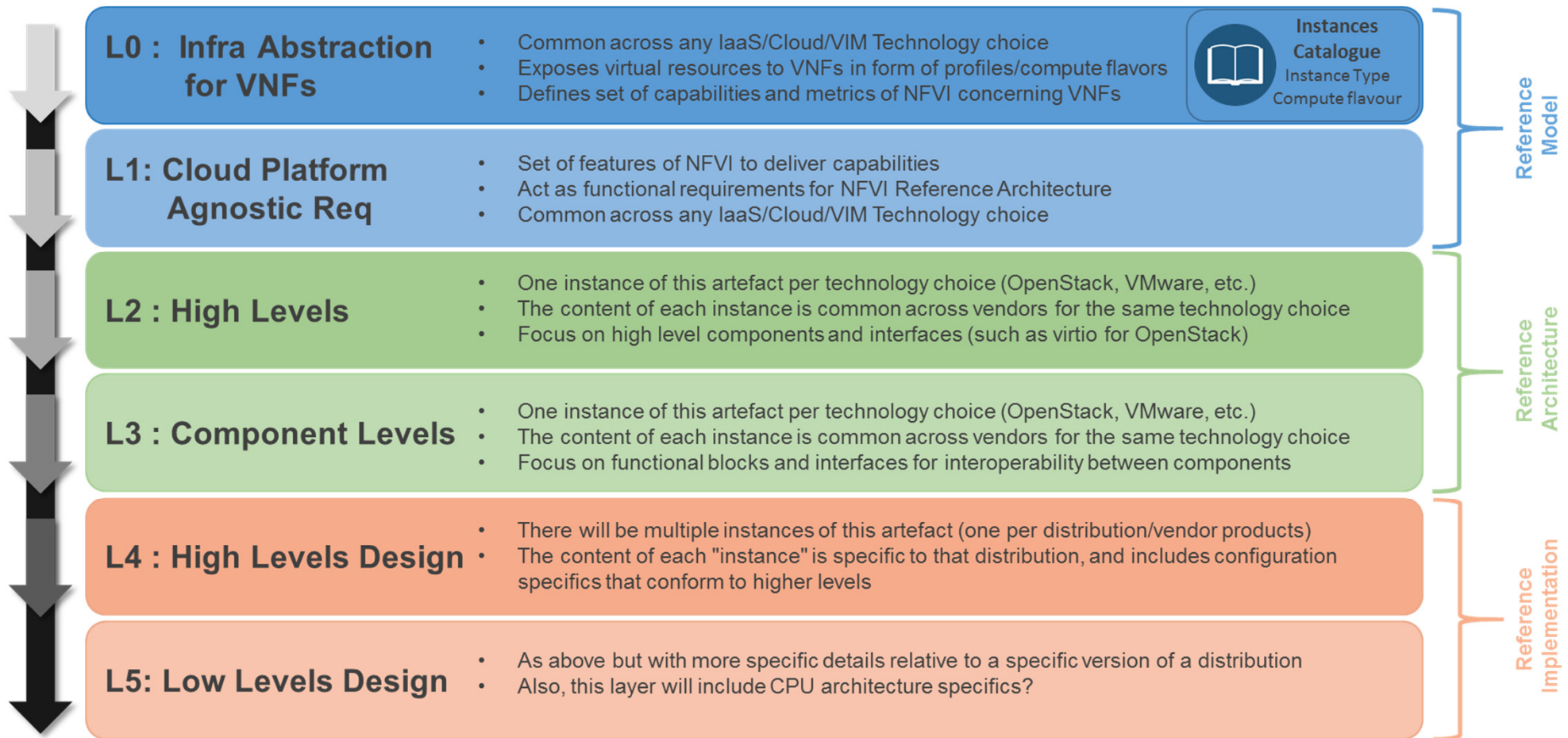
Project	Purpose	Recommendation
FuncTest	<ul style="list-style-type: none"> Functional interoperability validations 	<ul style="list-style-type: none"> ✓ ADOPT, as an RI suite. Covers 2k+ Openstack Interoperability Validations ✓ Augment to include Baremetal testing for Manifest Validations
Yardstick	<ul style="list-style-type: none"> VNF/Payload performance validations 	<ul style="list-style-type: none"> ✓ ADOPT, 62 TCs, leverages Shaker and YAML for test-case development ✓ Augment to perform POD restarts and HA for Maria/Ceph restarts
VSPerf	<ul style="list-style-type: none"> vSwitch perf testing 	<ul style="list-style-type: none"> ✓ ADOPT, for OVS-DPDK validations with 32 perf and functional TCs ✓ Setup external packet generator to avoid latency caused by the tool.
DoveTail	<ul style="list-style-type: none"> Automation framework 	<ul style="list-style-type: none"> ✓ ADOPT, with large number of test cases for conformance evaluation
Barometer	<ul style="list-style-type: none"> Platform availability and NW usage validations 	<ul style="list-style-type: none"> ✓ ADOPT, for use of NFVI+VNF validations capturing Telemetry data ✓ Augment to include device specific resiliency testing and monitoring.
"NEW"	<ul style="list-style-type: none"> Baremetal Validations 	<ul style="list-style-type: none"> ✓ CREATE New Baremetal Validations to verify engineering packages
"Augment"	<ul style="list-style-type: none"> Spirent Validations 	<ul style="list-style-type: none"> ✓ Augment projects with 240 TC adds for load, scaling, cloud migration.
"NEW"	<ul style="list-style-type: none"> Chaos Toolkit 	<ul style="list-style-type: none"> ✓ CREATE New, project to test POD resiliency by injecting chaos (failover)
Bottlenecks	<ul style="list-style-type: none"> Stress Testing 	<ul style="list-style-type: none"> ✗ Not recommended with limited test sets and results categorization
Doctor	<ul style="list-style-type: none"> Computer NFVI Fault Mgmt validations 	<ul style="list-style-type: none"> ✗ Not recommended with limited/no coverage for SDN, KVM, or containers
XTesting	<ul style="list-style-type: none"> CICD tool chaining in CNTT validations. 	<ul style="list-style-type: none"> ? REQUIRES POC if CNTT NFVI requires ADOPTION and USE of tool chaining. ? There are no specific TCs, as XTesting is for chaining together CICD test projects, and not for NFVI validation.
NFVBench	<ul style="list-style-type: none"> NFVI Perf Measurements (at physical hardware/host level) 	<ul style="list-style-type: none"> ✓ ADOPT, as a complement to vsperf and yardstick ✓ Augment to expand SRIOV and/or OVS-DPDK test cases.

Backup Slides

COMMON NFVI LIFECYCLE FRAMEWORK



CNTT NFVI Reference Levels



Instance, Flavor, Acceleration Options – B / N / C

B Instance Basic

Can be instantiated in any Data Centre.

(I) Interfaces Options

1	1x 1Gbps	1D	2x 1Gbps	1T	3x 1Gbps	...
10	1x 10Gbps	10D	2x 10Gbps	10T	3x 10Gbps	...

B <I opt> . <flavour> . <S ext>

N Instance Network intensive

Aimed for regional data centres, Access, & POP.

(I) Interfaces Options

25	1x 25Gbps	25D	2x 25Gbps	40	1x 40Gbps	...
40D	2x 40Gbps	100	1x 100Gbps	100D	2x 100Gbps	...

N <I opt> . <flavour> . <S ext> . <A ext>

C Instance Compute intensive

Aimed for local data centres, and on Edge.

(I) Interfaces Options

25	1x 25Gbps	25D	2x 50Gbps	40	1x 40Gbps	...
40D	2x 40Gbps	50	1x 50Gbps	50D	2x 50Gbps	...

C <I opt> . <flavour> . <S ext> . <A ext>

Compute Flavours

.tiny	1 vCPU	512MB RAM	1 GB Disk	1 Gbps
.small	1 vCPU	2 GB RAM	40 GB Disk	1 Gbps
.medium	2 vCPU	4GB RAM	40 GB Disk	1 Gbps
.large	4 vCPU	8GB RAM	80 GB Disk	1 Gbps
.large2	4 vCPU	16GB RAM	80 GB Disk	1 Gbps
.xlarge	8 vCPU	16GB RAM	160 GB Disk	1 Gbps
.xlarge2	8 vCPU	32GB RAM	160 GB Disk	1 Gbps
.xlarge3	8 vCPU	64GB RAM	160 GB Disk	1 Gbps

S extensions (Ext. Storage)

.100GB	default storage type
.200GB	default storage type
.300GB	default storage type
.blk100GB	block storage type
.blk200GB	block storage type
.blk300GB	block storage type

Network Acceleration (A extension)

.la-crypto	crypto look-aside
.il-ipsec	ipsec in-line

Compute Acceleration (A extension)

.la-trans	transcoding look-aside
.la-prog	Programmable look-aside

*up to 6 network interfaces per instance

Examples:

<p>B10.tiny</p> <p>1x 10 Gbps 1 vCPU 512MB RAM 1 GB Disk 1 Gbps</p>	<p>N40D.large</p> <p>2x 40 Gbps 4 vCPU 8GB RAM 80 GB Disk 1 Gbps</p>	<p>C50.large.la-trans</p> <p>1x 50 Gbps 4 vCPU 8GB RAM 80 GB Disk 1 Gbps .la-trans</p>
<p>B10T.small.100GB</p> <p>3x 10 Gbps 1 vCPU 2GB RAM 50 GB Disk 1 Gbps .100GB</p>	<p>N40.medium.obj100</p> <p>1x 40 Gbps 2 vCPU 4GB RAM 40 GB Disk 1 Gbps .obj100GB</p>	<p>C100D.xlarge2.il-ipsec</p> <p>2x 100 Gbps 8 vCPU 32GB RAM 160 GB Disk 1 Gbps .il-ipsec</p>

Software & Hardware Profiles

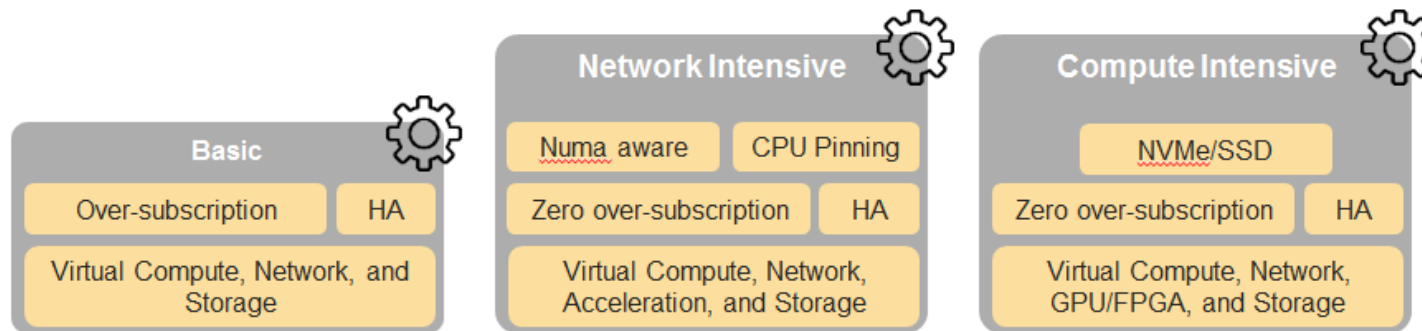


Figure 5-3: NFVI software profiles.

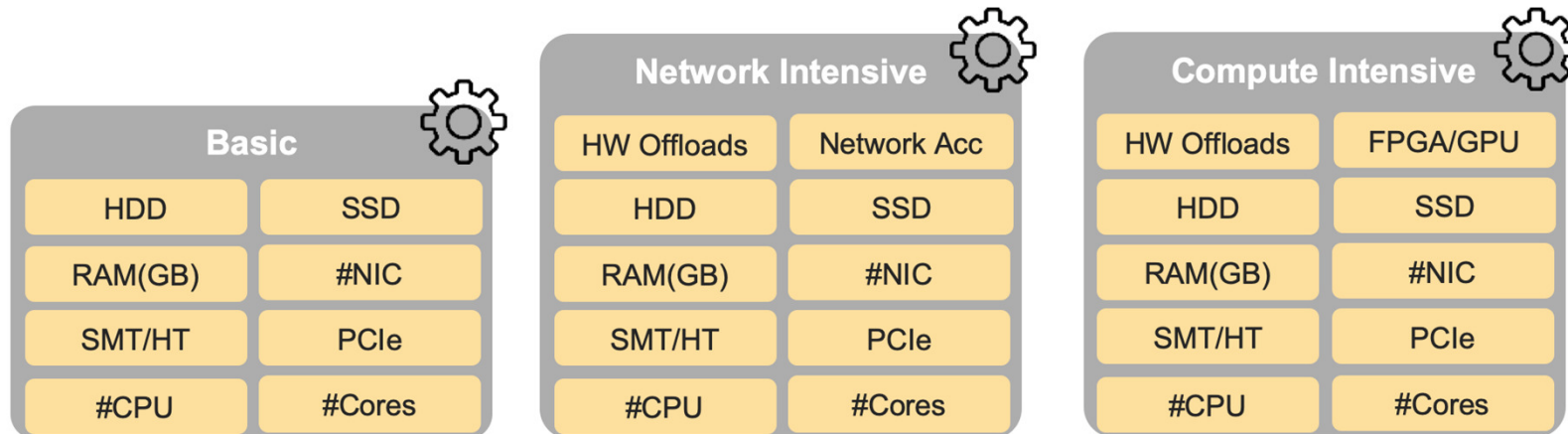


Figure 5-4: NFVI hardware profiles and host associated capabilities.

Current OPNFV/OVP Certification Process

CVC Compliance, Verification, and Certification governing framework:

- **Compliance testing:** compares the system under test against the specifications / standards
- **Validation testing:** ensures the system under test is operating according to its intended / required purpose
- **Performance testing:** measures how well the system under test performs its specific purpose(s)

OVP certifications are accomplished as a two-part process:

1. OPNFV provides Test Tools and Test Cases to OVP.
2. OVP provides vendor NFVI products a "badge" claiming "OPNFV-certified" once OVP testing passes successfully (via Dovetail).

Test frameworks and supported test cases for OVP Certifications include (OPNFV and ONAP):

1. OPNFV – NFVI Testing and Certification

CVC Category: Validation, Compliance

Purpose: NFVI platform is checked against the Open Stack requirements

Test framework, test result database and Web UI

Dovetail project

Test tools, test cases and test execution

API testing (**FuncTest**)

Performance and HA (**Yardstick**)

Load testing (**Bottleneck**)

2. ONAP – VNF Testing and Certification

CVC Category: Compliance, Performance

Purpose: VNF template is checked against the ONAP Requirements

- VNF Validation/Packaging Compliance (HEAT and TOSCA/CSAR/VFD)
- Web front-end integrated with OPNFV Dovetail Web UI
- Future plan: testing of VNF lifecycle, VNF functions, VNF performance

VNF Validation Testing - CVC and ONAP teams are working to develop the initial life-cycle tests for VNF devices. The first release will run on the "basic open stack" meeting ONAP requirements. Future versions would require this to be the reference NFVI defined by CNTT

Test & Validation: OPNFV/OVP Entry/Exit Criteria

ENTRANCE CRITERIA

OPNFV entrance criteria must be satisfied for VNF certification.

Demonstration of Reference Architecture Implementation

Design & Requirements

- Design, Configuration, Features, SLAs, and Capability documentation complete
- Users stories / Adherence to CNTT Model principles and guidelines
- Chosen RA Matches a RA from the product catalog

Environment

- Lab / Flavor, component s/w rev levels specified, with confirmation of compatibility with external systems
- Tenant needs identified
- All connectivity, network, image, VMs, delivered with successful pairwise tests
- Lab instrumented for proper monitoring

Planning & Delivery

- Kickoff / Acceptance Criteria reviews performed
- Delivery commitments, timelines, and cadence accepted
- Confirm backward compat. across software/flavor rev levels

Data / VNFs / Security

- Images, Heat Templates, Preload Sheets available
- Images uploaded to tenant space
- External system test data needs identified
- Owners (NFVI, VNF, PTL, etc) documented
- Security Compliance Satisfied (see Ch. 8 – scans, vulnerabilities)

Test Case Contributions

- VNF Developer/Supplier validations to be performed documented and supplied
- NFVI validations to be performed supplied (e.g. echo, manifest)
- Test to ensure users are added and have correct privileges for the tenant
- Test to ensure quota against submitted request for the respective tenants
- Test to ensure custom flavors against submitted request for respective tenants

EXIT CRITERIA

CERTIFICATION TENANTS (via OVP Ecosystem)

- All Test Cases have a status of “Passed”, “Failed”, “N/A” or “Out-scoped”.
- All Severity 1 and Severity 2 issues are resolved.
- All Issues have been Resolved or the Project/Component Team has voted unanimously for a Conditional Certification.
- Known defects, or issues, are clearly documented and furnished to Telco providers with certification notes.
- Certification Notification(s) issued.

OPERATIONAL CONSIDERATIONS (TELCO PERSPECTIVE)

- Orchestration capabilities verified to be working as expected
- Fabric setup/configuration validations successfully passed
- Openstack API endpoint is reachable and working for that zone
- Compute zones and cinder types verified
- Standard images verified to exist (and usable)
- Network object created (and working, as in IPs are bindable and usable)
- Resolver overlay/DNS traffic/port 53 overlay on gateway is working properly
- Designate is working, domain preferably created, and maybe test A record created/verified to be resolvable
- Standard NTP servers are working and verified (using tenant's CIDR source IP)
- NFVI/VNF is tested at steady state and high load
- Continuously monitored to ensure SLAs are met and used as feedback to load/perf tests

END USER CONSIDERATIONS (TELCO PERSPECTIVE)

- Component redundancy to ensure graceful updates without disruption of services
- Thin provisioning storage should handle actual full quota usage cases
- Load balancing should support elasticity
- SRIOV Network configuration via SDN must be aware of all VMs on a host (and their network config)
- Auto-healing databases (any component related db) when out of sync
- Obvious, but, supports all required network functionality (all protocols, service chaining, VLAN trunking, QoS marking, probe/mirror, etc)
- Supports NFV migration
- Supports snapshots and backups of large volumes
- Pre-check or audit failures during NFV deployment should allow follow-up mitigation, when possible, rather than killing deployment and rolling back

Test Category / Case Gap Summary.. Continued

Recommend Adopt and/or Augment

Project	Gaps	Recommendation
FuncTest – functional interoperability validations	<ul style="list-style-type: none"> Doesn't directly verify Baremetal and Operating System for Manifest Validations 	<ul style="list-style-type: none"> ✓ ADOPT as an RI suite. Covers large (2k) Openstack Interoperability Validations including test support of Dovetail, Pharos, AirShip, and Fuel, for example. ✓ Augment to include Baremetal testing, or stand up separate test project to cover Baremetal which supports "Manifest Validations". ✓ Reuse functest-smoke (functional test mostly based on tempest), functest-benchmarking (rally_full and rally_jobs) and possibly the other tiers.
Yardstick - VNF/Payload performance validations	<ul style="list-style-type: none"> SRIOV/DPDK: No frame-size (MTU) for validating VNF perf parameters No TCs defined for emerging OVS-DPDK 	<ul style="list-style-type: none"> ✓ ADOPT, 62 TCs, leverages Shaker and YAML for test-case/scenario development. ✓ Augment <ul style="list-style-type: none"> ✓ (tc025 node down HA check) to perform POD restarts on nova, neutron, etc. ✓ HA framework to check MariaDB and CEPH during node restarts. ✓ Reuse as TCs are broad across core components, resiliency, HA, compute, network, and storage. TC test general VNF requirements of: latency, throughput, packet-loss, IOPS.
VSPerf – vswitch perf testing	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> ✓ ADOPT for OVS-DPDK validations with 32 TCs covering performance and functional testing, validating Throughput, Scalability, Memory, NIC acceleration, etc. ✓ Setup external packet generator tool from the SUT to avoid latency caused by the tool.
DoveTail – automation framework	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> ✓ ADOPT, as an automation framework with access to large number of test cases for conformance evaluation tests such as security flaws in OpenStack(VIM), K8s, Tenant HA and various other conformance areas.

Test Category / Case Gap Summary.. Continued

Recommend Adopt and/or Augment

Project	Gaps	Recommendation
Barometer – platform availability and NW usage validations	<ul style="list-style-type: none"> Limited coverage with VNF traffic monitoring, or network usage. Includes, but not limited to monitoring VNF when traffic is introduced, handling of that traffic, or reacting to faults to confirm resiliency of the device.. 	<ul style="list-style-type: none"> ✓ ADOPT. for use of NFVI+VNF validations given the broad breadth of evaluations performed with the Barometer framework: CPU utilization, Monitoring, Telemetry, etc. ✓ Augment to include device specific resiliency testing and monitoring.
"NEW" – baremetal validations	<ul style="list-style-type: none"> Baremetal Validations lacking from any known project. 	<ul style="list-style-type: none"> ✓ CREATE New, or confirm if Baremetal Validations can be inserted into an existing project to validate baremetal delivery matches the manifest, or engineering package provided. <ul style="list-style-type: none"> ✓ e.g. validations to include, but not limited to: NUMA config checks, NIC frame size (MTU), Huge Page configuration, BIOS, Firmware, checks etc.
"NEW" – Spirent Partner	<ul style="list-style-type: none"> Gaps in NFVI Assurance, VIM/OpenStack Assurance, and VNF & NS LCM (Life Cycle Mgmt) 	<ul style="list-style-type: none"> ✓ Augment existing test projects, or possibly Create New, with the following additional test cases: <ul style="list-style-type: none"> ✓ NFVI Assurance – add 30 TCs, extreme scale load generation, cloud migration assistance ✓ VIM/OpenStack Assurance – add 70 TCs, VIM scale testing and consistency checks at scale ✓ VNF & NS LCM (Life Cycle Mgmt) – add 140 TCs, VNF/NS LCM autoscaling testing
"NEW" – Chaos Toolkit	<ul style="list-style-type: none"> Lack of tool/project to measure uncertainty of distributed systems at scale to discover platform weakness 	<ul style="list-style-type: none"> ✓ CREATE New, or confirm existence of, a tool to test the Kubernetes PODs for resiliency by injecting chaos and test if the PODs recover from chaos. <ul style="list-style-type: none"> ✓ e.g. scenarios include: Node failover testing, RabbitMQ resiliency, impacts during CEPH outage, container POD eviction and replication after shutdown, etc.

Test Category / Case Gap Summary.. Continued

Not Recommended

Project	Gaps	Recommendation
Bottlenecks – stress testing	<ul style="list-style-type: none"> Limited test-suites, needing stability, robustness, and SLA test suites/capabilities Not built out as a tool that considers different hardware and middleware capabilities along with true VNF load testing. 	<p>✗ Not recommended as a CNTT test suite as it relies on other test projects for test cases.</p> <p>✗ With limited test sets, categorization of results will not paint the whole picture and as such, other tools (albeit outputs without categorization) may be better suited.</p>
Doctor – compute/NFVI fault mgmt.	<ul style="list-style-type: none"> Few parameters based on which the fault mgmt. alarms are triggered such as VM status(whatever nova provides), Port issues affecting connectivity. 	<p>✗ Not recommended as TCs need to be enhanced to cover more fault scenarios – SDN, KVM, etc.</p> <p>✗ Recommendation is for Doctor PTL to extended fault monitoring to container infrastructure, and not be limited to VIM/OpenStack.</p>
XTesting – CICD tool chaining	<ul style="list-style-type: none"> None; however, PoC required to evaluate need-for CICD tool chaining in CNTT validations. 	<p>? REQUIRES POC if CNTT NFVI requires ADOPTION and USE of tool chaining.</p> <p>? There are no specific TCs, as XTesting is for chaining together CICD test projects, and not for NFVI validation.</p>
NFVBench – NFVI perf (blackbox)	<ul style="list-style-type: none"> Limited SRIOV and/or OVS-DPDK validations for NIC virtualization testing. 	<ul style="list-style-type: none"> ✓ ADOPT, as a complement to vsperf and yardstick which measure VM level NFVI perf, whereas NFVBench evaluates NFVI from the physical hardware/host level, and includes an extensive test coverage around VxLAN. ✓ Augment to expand SRIOV and/or OVS-DPDK test cases.

CNTT | Roadmap

Reference Model

Reference Architecture

Reference Implementation

RM 1.0

RA 1.0
openstack

RM 2.0

Botrange

RA 1.0
openstack

RI 1.0
openstack

RA 2.0
openstack

RM 3.0

Stable

TBD

RA 2.0
openstack

Infrastructure
OPNFV VERIFIED
2018.09

RI 2.0
openstack

RA 3.0
openstack

RM 3.x

Stable

TBD

RA 3.0
openstack

VNF
OPNFV VERIFIED
2019.04

Infrastructure
OPNFV VERIFIED
2018.09

RI 3.0
openstack

RA 3.x
openstack

RM 3.x

Stable

TBD

