Common NFVI Telco Taskforce
Technical F2F Work Shop – January 13-16, 2020

RC Workstream: Key Updates

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Content & MVP Targets
Progress to Date | Key Accomplishments

Objectives

- Re-write(WIP) for Certification Process/Frameworks/Badging
- Onboard Additional Team Support (Frameworks), Methodologies, Badging
- Stage Jenkins Hosts & Enable Daily Jobs for Health/Smoke Suites
- Setup & Perform initial compliance validations
- Identify Gaps (audit) in initial Alpha RI Release and expected compliance validations
- Initial Badging Framework for NFVI | VNFs
- Certification Process Drafted
- Automation Tool Chain Framework
Level Set on MVPs

Initial Badging Framework for NFVI | VNFs

- **Lab** setup
- **Compliant** requirements
- **Execution** empirical, verification & validation

Certification Process Drafted

- **Certified Lab** utilized
- **Test Case Traceability** to req’s
- **Execution** complete & passing
- **Results Collation** normalized & centralized

Automation Tool Chain Framework

- **Refactor** existing OVP toolchain
- **Versatile** test harnesses using standard interfaces & services
- **Supplier Integration enabling** VNF testing using Supplier Apparatus
- **Adaptable** & Portable Tool Chaining across releases

- **Evidence** meeting qualifications
- **Governance (Badging) reviews & badging**

- **Evidence** meeting qualifications
- **Governance** reviews of Entry/Exit criteria and certification
Progress: Initial Content Creation

Initial Content

**NFVI**
- Ch01: Introduction
- Ch02: NFVI E2E C&V Framework Requirements
- Ch03: NFVI Test Case Requirements
- Ch04: NFVI TC Traceability to RA Requirements

**VFN**
- Ch05: VNF E2E C&V Framework Requirements
- Ch06: VNF Test Case Requirements
- Ch07: VNF TC Traceability to RM Requirements

**DEV**
- Ch08: E2E Framework Integration
- Ch09: NFVI Tests Traceability to TC Requirements
- Ch10: VNF Tests Traceability to TC Requirements
- Ch11: Gap analysis & Development

“RI-Alpha & RC-Pre Alpha Phase”

**Delivered - Snezka MVP**
- Defined Certification
- Provide NFVI and VNF Certification Methodology
- Outline E2E Frameworks for Tools, Badges, and Process
- Include Gaps Identified During Installation

**Next Release**
- Include Normalized Results Template & Repo
- Finalize TC Requirements and Traceability
- Reach consensus on Entry & Exit Criteria
Progress: Badging Requirements

Badging Requirements

Badging Defined

Granting of certification by the OVP to Suppliers of NFVI+VNF upon demonstrating testing confirms:

- NFVI adheres to CNTT RA/RM requirements.
- VNFs pass interoperability tests on target NFVI with acceptable levels of stability and performance.

Suppliers seeking NFVI & VNF certification will furnish the following:

<table>
<thead>
<tr>
<th>Category</th>
<th>OVP/CVC Expectation</th>
<th>Supporting Artifact(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>Delivered test lab conforms to RI-x lab requirements for SUT</td>
<td>Bare-metal H/W Validations</td>
</tr>
<tr>
<td>Compliance</td>
<td>Installed software conforms to RM/RA requirements for components &amp; options</td>
<td>Manifest S/W Validations</td>
</tr>
<tr>
<td>Validation</td>
<td>FR Validation of Component and API functional behavior meets requirements</td>
<td>API &amp; Platform Test Results</td>
</tr>
<tr>
<td>Performance</td>
<td>NFR Validation of Component, Interface, and API, results are within baseline tolerance</td>
<td>Performance Test Results</td>
</tr>
<tr>
<td>Results Reporting</td>
<td>Test Results published into centralized and common repository &amp; portal</td>
<td>Normalized Results per Standards</td>
</tr>
<tr>
<td>Release Notes</td>
<td>Supplier provides concluding remarks, links to artifacts, having met exit criteria for testing</td>
<td>Release Notes</td>
</tr>
</tbody>
</table>
Progress: Badging Requirements.. Test Results

Categorization
Test suites – Functional/Platform or Performance based

Results
Test results communicated as boolean (pass/fail), or Measurements Only
- **Functional Pass/Fail** - assertions in a test script verify the FR met its stated objective delivered by the developer
- **Performance-based Pass/Fail** - compares measured results with NFR KPIs &/or Reference VNF KPIs
- **Measurement Results** - baseline measurements when no benchmarks available to compare

Collation | Portal
Criteria applied to collation and presentation of test-result data:
- RA number and name (e.g. RA-1 OpenStack)
- Version of software tested (e.g. OpenStack Ocata)
- Normalized results will be collated across all test runs (i.e. centralized database)
- Clear time stamps of test runs will be provided.
- Identification of test engineer / executor.
- Traceability to requirements.
- Summarized conclusion if conditions warrant test certification (see Badging Section).
- Portal contains links to certification badge(s) received.
Reference Certification

Objective
Deliver community certified NFVI | VNFs | CNFs to the Service Provider Marketplace

Goals
- Provide uniform approach for NFVI | VNF | CNF certification process, lifecycle, & badging
- Certify VNF | CNF on infrastructure, instantiation, tear-down, performance, & resiliency
- Provide VNFs | CNFs with effective & efficient intake & onboarding for Lab Management
- Ensure test framework can be reused for Manifest, Empirical, and Interoperability validations for new distributions

Target Delivery
March | April 2020 (v 1.0 - Alpha)
Aligns with Reference Architecture # 1 (OpenStack)
Progress: Certification Process Framework

Certification Process Framework

Core Principles

• **Certification fulfilled** by the OPNFV Verified Program (OVP), under the Linux Foundation Networking (LFN) umbrella

• Program **overseen** by the Compliance Verification Committee (CVC) providing tracking and governance

• **NFVI and VNFs supplied** by vendors **must adhere** to Reference Model (RM) and Reference Architecture (RA)

By Definition

• **Verification** conformance that NFVI is delivered per implementation specifications

• **Validation** testing performed confirms the actual output of a product meets the expected or desired outcome, or behavior

• **Certification** issuance of NFVI/VNF badges in recognition of the successful completion of verification and validation testing

Certification and Issuance of NFVI+VNF Badges

✓ Utilization of target RM/RA-x certified RI lab
✓ Traceable test cases to requirements
✓ Adoption & Execution of Xtesting for RC pre-alpha validations

✓ Collation of Normalized Results in Centralized Repository
✓ Entry and exit criteria satisfied
✓ Required artifacts supplied to the OVP
Reference Certification Achievements | Targets for Alpha
NFVI Compliance

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
- MANO for VNFs
- Validating VNF’s ability to be upgraded
- Georedundant and Load Testing

RI-Alpha & RC-Pre Alpha Release

**Xtesting and Xtesting CI meet Requirements** for verification, compliance and certification:

- Assembly of multiple heterogeneous test cases
- OPNFV Release Engineering Jenkins jobs to verify RI
- Test case results & logs for third-party certification review
- Deploy local CI/CD toolchains to verify RI compliance

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Framework

✓ CICD approach utilizing common components and frameworks:
  ✓ RI verification: centralized LF CI toolchain
  ✓ RC compliance and cert: local LF-compatible CI toolchains
✓ Defining first framework requirements to simplify CI toolchain:
  ✓ Common test case execution
  ✓ United way to manage interactions with CI/CD components and with third-parties
✓ Xtesting was pragmatically selected:
  ✓ Meets CNTT requirements
  ✓ Allows easy adding any new test case
✓ The first test case requirements have been published:
  ✓ Test cases delivered as Docker containers
  ✓ Xtesting package and the related test case execution description file included
Certification Process | Gap Analysis

**Process**

- **Certification based on successful delivery of:**
  1. **Manifest Verifications** – confirming NFVI delivered per RI-x requirements.
  3. **Interoperability Validations** – confirming capabilities, stability and perf.

- **For NFVI Certification:**
  - Vendor NFVI/VIM images under Test will be installed and configured.
  - For Phase 1, OPNFV **Functest** tests used for Compliance and Validation.

- **For VNF Certification:**
  - Vendor VNF images are ingested by the CICD pipeline, implemented in lab.
  - VNF on-boarding and lifecycle operations validation is performed using upstream projects such as VNFSDK and VPP.

- Test results submitted to OVP for review by committee. If results are validated, the vendor’s application for certification is approved and the badge(s) awarded.

**Gaps**

- No automated means for Manifest (s/w) or Lab (h/w) Validations.
- Need support vehicle for Installer changes (to meet RI-x specs).
- Normalization and Centralization of Results Alignment needed.
- Storage and Performance scenarios (or tools) missing.
- Need Installers which are OpenStack release agnostic.
- Need priority on lab support with proactive monitoring.
## Exceptions: Certifications From the OVP Process

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>Step 2:</th>
<th>Step 3:</th>
<th>Step 4:</th>
<th>Step 5:</th>
<th>Step 6:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submission of Participation Form</td>
<td>Testing</td>
<td>Submission of Results</td>
<td>Notification of Reviewers</td>
<td>Community Review of Test Results</td>
<td>Grant of Use of Program Marks</td>
</tr>
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</table>

**OPNFV Verification Program (OVP)** is a five step process resulting in the issuance of three badges: NFVI, VNF, and Lab

**CNTT seeks to align with the OVP process, noting three Gaps above in process:**
- **Step 1** for client (NFVI/VNF) participation in badging and certification
- **Step 2** for Test(ing) & tools utilized for testing
- **Step 6** for Badging Guidelines

**Mitigating Process Gaps:**
- **Step 1:** Friendly and Controlled Introductions in 2020, using key learnings to create formal participation mechanism
- **Step 2:** Adopt Xtesting as OVP certified Platform Alternative, Expand Test Coverage onboarding/augmenting Test Projects
- **Step 6:** OVP accepts cookbook results as fulfillment for CNTT NFVI conformance/certification (all actors will run cookbook)
Results: Compliance

With RI-Alpha

• Continuously running deployment, verification and CNTT compliance
• 6 Commands to configure the RI daily jobs or to deploy the local toolchain within minutes
• Compared to OVP scope, API testing coverage increased from 15% to 100% as proposed by Functest
• In addition to API testing, test run for Compliance Verification now include:
  • API and data plane benchmarking
  • VNF deployment and testing
• RI and TC development verification implemented (Functest CI successfully checks its CNTT deliverables

**Conclusion:** Successfully audited the RI System Under Tests (SUT), identifying installer changes to enable RI deployments, & confirming RA1 Chapter 5 (API) feature capability and exposure per OSH Ocata.

Observations

• OpenStack Helm (OSH) doesn't support live migration and resize server for Ocata
• Metrics needed for API / data-plane benchmarking

Recommendations (for RC-Alpha)

• Implement Stein, OSH supported
• Update RM/RA-1 OpenStack documentation for Stein
• Link RI gates to verification tests
• Leverage Xtesting to wrap the RI deployment calls, simplifying the RI “cookbook”
Next Steps

Current Status

Completed:
- RM | RA | RI Requirements
- Lab Requirements
- Initial Lab Secured
- S/W Deployed | Config
- Smoke Test | Sanity
- Continuous Deployment (with errors)

In-Progress
- Manifest > PDF & IDF
- Complete Lab PoC & Deliver Lab
- Create Cookbook & RI Topology artifact
- Implement PoC Key Learnings

Completed:
- Define & Vet Verification Methodology
- Stage Jenkins Hosts
- Prep Health/Smoke Suites
- Completed API test harness setup
- Initial API Compliance Validation

In-Progress
- Design & deliver VNF Prototypes
- Integrate upstream community performance & storage test cases

Note: All events & dates are pending community alignment
Reference Certification Challenges

• Availability of OVP | CNTT resources & active engagement
• **OVP’s ability to scale to demand, & alignment with CNTT objectives, including:**
  - Fully automated ecosystem & badging process
  - Intuitive and efficient VNF on-boarding processes
  - Lab optimization & rationalization
  - Lab-use management & control strategy
    - Augmentation of OVP processes to include third party certification platforms & process
    - Clear and efficient third party certification requirements
    - Audits of lab certifications confirming availability, state (current), & accessibility
• Normalized test results with a centralized repository
• Manifest validations require an automated check of requirements

**CNTT will maintain ownership of the Reference Certification until a satisfactory level of support, stability, & maturity is attained**
## Reference Certification Approach | Outcomes

<table>
<thead>
<tr>
<th>Actions Underway</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define requirements &amp; criteria for profile based implementations &amp; certifications</td>
<td>Clearly defined requirements to assess vendor software, hardware, and VNF solutions</td>
</tr>
<tr>
<td>Define badging requirements to achieve certification</td>
<td>Deliver compliant &amp; stable VNFs</td>
</tr>
<tr>
<td>Define, align, and select NFVI</td>
<td>VNF</td>
</tr>
<tr>
<td>• Infrastructure</td>
<td>• Tear-Down</td>
</tr>
<tr>
<td>• Instantiation</td>
<td>• Performance</td>
</tr>
<tr>
<td>Establish guidelines and/or processes for:</td>
<td>Ensure proper level of structure &amp; discipline exists within test ecosystem to effectively manage &amp; scale to demand</td>
</tr>
<tr>
<td>• Entry</td>
<td>Exit Criteria</td>
</tr>
<tr>
<td>• Test Categories</td>
<td>• Test Case In-Take</td>
</tr>
<tr>
<td>Define &amp; align across communities on the test framework &amp; tooling</td>
<td>Optimized test ecosystem, designed to scale, manage, &amp; perform VNF</td>
</tr>
</tbody>
</table>
Relationship with CVC

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
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

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
- Entry and Exit Quality Standards are satisfied
- Ensure test harnesses can be ported and utilized across multiple distributions
- 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
Test Category / Case Gap Summary

Projects Identified

- * Airship Installer
- Bottleneck
- Barometer
- Doctor
- * Dovetail
- * Fuel
- Functest
- * High Availability
- NFV Bench
- * Pharos
- Sample VNF
- VSPerf
- Yardstick

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

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
<table>
<thead>
<tr>
<th>Project</th>
<th>Purpose</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functest</td>
<td>Functional interoperability validations</td>
<td>✓ <strong>ADOPT</strong>, as an RI suite. Covers 2k+ Openstack Interoperability Validations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ <strong>Augment</strong> to include Baremetal testing for Manifest Validations</td>
</tr>
<tr>
<td>Yardstick</td>
<td>VNF/Payload performance validations</td>
<td>✓ <strong>ADOPT</strong>, 62 TCs, leverages Shaker and YAML for test-case development</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ <strong>Augment</strong> to perform POD restarts and HA for Maria/Ceph restarts</td>
</tr>
<tr>
<td>VSPerf</td>
<td>vSwitch perf testing</td>
<td>✓ <strong>ADOPT</strong>, for OVS-DPDK validations with 32 perf and functional TCs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ <strong>Setup</strong> external packet generator to avoid latency caused by the tool.</td>
</tr>
<tr>
<td>DoveTail</td>
<td>Automation framework</td>
<td>✓ <strong>ADOPT</strong>, with large number of test cases for conformance evaluation</td>
</tr>
<tr>
<td>Barometer</td>
<td>Platform availability and NW usage validations</td>
<td>✓ <strong>ADOPT</strong>, for use of NFVI+VNF validations capturing Telemetry data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ <strong>Augment</strong> to include device specific resiliency testing and monitoring.</td>
</tr>
<tr>
<td>“NEW”</td>
<td>Baremetal Validations</td>
<td>✓ <strong>CREATE New</strong> Baremetal Validations to verify engineering packages</td>
</tr>
<tr>
<td>“Augment”</td>
<td>Spirent Validations</td>
<td>✓ <strong>Augment</strong> projects with 240 TC adds for load, scaling, cloud migration.</td>
</tr>
<tr>
<td>“NEW”</td>
<td>Chaos Toolkit</td>
<td>✓ <strong>CREATE New</strong>, project to test POD resiliency by injecting chaos (failover)</td>
</tr>
<tr>
<td>Bottlenecks</td>
<td>Stress Testing</td>
<td>✗ <strong>Not recommended</strong> with limited test sets and results categorization</td>
</tr>
<tr>
<td>Doctor</td>
<td>Computer NFVI Fault Mgmt validations</td>
<td>✗ <strong>Not recommended</strong> with limited/no coverage for SDN, KVM, or containers</td>
</tr>
<tr>
<td>Xtesting</td>
<td>CICD tool chaining in CNTT validations.</td>
<td>✗ <strong>REQUIRES POC</strong> if CNTT NFVI requires ADOPTION and USE of tool chaining.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✗ <strong>There are no specific TCs</strong>, as Xtesting is for chaining together CICD test projects, and not for NFVI validation.</td>
</tr>
<tr>
<td>NFVBench</td>
<td>NFVI Perf Measurements (at physical hardware/host level)</td>
<td>✓ <strong>ADOPT</strong>, as a complement to vsperf and yardstick</td>
</tr>
<tr>
<td>MF</td>
<td></td>
<td>✓ <strong>Augment</strong> to expand SRIOV and/or OVS-DPDK test cases.</td>
</tr>
</tbody>
</table>