The Interoperability Challenge in Telecom and NFV Environments

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Testing Pipeline Paradigm

Integration level increases from unit testing to end-to-end service testing

Upstreaming test execution reduces cost and efforts

Upstreaming test plans over time increases quality and enables automation

Open source testing → Commercial implementation testing → Industry-wide interoperability testing → Operator-led individual testing

Deployment
Open Source Interoperability
Problems and Challenges

Richness and flexibility → The bright and dark side in one

- Various configuration options
- In some cases multiple ways of achieving the same goal
- Mixed environments with multiple versions

Challenges

- Policy and configuration discovery
- API iteration and tool/SDK release cadence
- Documentation
OpenStack Interoperability Working Group

- Founded in 2013 Fall
- Mission is to fulfill the “Faithful Implementation Test Suite” (FITS) mandate
- Producing guidelines, first placed into effect in Spring 2015
- Guidelines
  - Components
  - Capabilities
  - Designated Sections

https://wiki.openstack.org/wiki/Governance/InteropWG
http://lists.openstack.org/cgi-bin/mailman/listinfo/interop-wg
OpenStack  ⬀  RefStack

- Toolset for testing interoperability between OpenStack clouds
- Integrated with OpenStack Tempest test framework
- Run tests locally
- Store results centrally - database backed website

https://refstack.openstack.org/
https://wiki.openstack.org/wiki/RefStack
The CVP
(compliance and verification program)

The OPNFV CVP is a compliance verification program intended to increase the awareness and adoption of OPNFV by demonstrating the readiness and availability of commercial products based on OPNFV.

The key objectives and benefits of the OPNFV CVP are to:

● Help build the market for
  ○ OPNFV-based infrastructure
  ○ applications designed to run on that infrastructure
● Reduce adoption risks for end-users
● Decrease testing costs by verifying hardware and software platform interfaces and components
● Enhance interoperability
The **OPNFV** CVP - foundation
The CVP - 2 years in the making

 Deploy - Test - Iterate

Evaluate - Improve - Iterate
Benefits of the CVP
Commercial Interoperability
About the European Advanced Networking Test Center

- State of the art testing expertise focusing on innovative telecom technologies
- Emulating fully realistic scenarios representative for today’s production networks
- EANTC is 100% independent and vendor-neutral
- Adhering to highest quality standards and actively participating in test methods standardization

Network Design, Proof of Concept Testing and Audits for Service Providers
Testing and Certification for Vendors
Acceptance Tests and Audits for Enterprises

[tested by EANTC 2017]

redefine the possible log in. berlin.
Important Quality Assurance Areas to Look for:

- Data Plane Performance
- Service Scalability
- High Availability
- Manageability
- Service Agility
- Diverse Functionality
State of the NFV Industry 1Q2017 (2)

Single Vendor Solutions Today:
- 😊😊 Data Plane Performance
- 😊😊 Service Scalability
- 😊😊 High Availability
- 😊 Manageability
- 😊 Service Agility (cloud native)
- 😊 (cloud-ready)
- 😊 Diverse Functionality

Some solutions already work well in a single-vendor environment
“Light” Multi-Vendor Today:
- 😊😊 Data Plane Performance
- 😊😊 Service Scalability
- 😊😊😊 High Availability
- 😊😊 Manageability
- 😊 Service Agility (cloud native)
- 😊 (cloud-ready)
- 😊 Diverse Functionality

A number of single-vendor NFV+MANO solutions work quite well already

In the diagram:
- **NFVI**
- **VIM**
- **VNF**
- **VNFM**
- **NFVO**
- **EM**
- **Next-Gen OSS/BSS**

Vendors 2+ and Vendor 1 are connected to illustrate the multi-vendor approach.
State of the NFV Industry 1Q2017 (4)

Full Multi-Vendor Solutions Today:
- ??? Data Plane Performance
- ??? Service Scalability
- ☺ High Availability
- ☺ Manageability
- ??? Service Agility
- ??? Diverse Functionality

Multi-vendor solutions require much more integration and quality assurance to become ready for production deployment.
The New IP Agency (NIA) is a not-for-profit independent initiative providing information, education, analysis, community services and testing to support and accelerate the development of a global economy based on open, advanced, virtualized IP networks.

- EANTC is NIA’s partner test lab
  - Technical Advisory Committee
  - Interoperability test creation, staging, execution and documentation
Recent EANTC NFV Interoperability Test Campaigns

**VNF Testing**
- NFVi-VNF Interoperability
  - Started Q3 2016

**2016 Showcase**
- Service Function Chaining
- Live Event BCE Austin

**MANO Testing**
- Orchestrator to Infrastructure interoperability
  - Q2/2017

**SDN / NFV**
- Integration of SDN into NFV service chains
  - Q3/Q4 2017

Participated in ETSI NFV MANO PlugTest
### VNF/NFVI Interoperability Results Matrix 2016

<table>
<thead>
<tr>
<th></th>
<th>Cisco NFVI</th>
<th>Dell EMC NFVI</th>
<th>Huawei Fusion-Sphere</th>
<th>Juniper Contrail</th>
<th>Nokia CloudBand</th>
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</table>

- **36 combinations passed**
- **17 failed/not completed combinations**
- **Success rate of 69%**
NIA Interoperability Showcase 2016

Results Highlights:

- 12 participants
- 6 six multi-vendor combinations of orchestrated service function chains (SFCs) on a range of NFV infrastructure (NFVI) solutions
- 1 week of dedicated-hot staging
- White paper publically available
Upcoming NIA MANO Test

- Evaluation of multi-vendor interoperability between Management and Orchestration (MANO) functions and Virtual Infrastructure Management (VIM)
- Test plan is subset of ETSI TST007 draft standard, which incorporates the test plan for recent ETSI PlugTest Q1/2017 (co-authored by EANTC)
- ETSI TST007 methodology is followed to maximize transparency, industry impact and alignment
- Results publication: May 16, 2017
Commercial Interoperability Challenges

- Different implementations are *based* on OpenStack but not *identical*
- Different OpenStack releases used in our test bed (Juno, Kilo, and Liberty) resulted in interoperability problems
- Telecom operators require multi-version interoperability which cannot be taken for granted
- OpenStack security policies differ which often resulted in VNF data plane connectivity issues
- OpenStack network policy improvements can potentially cause interruptions to existing VMs
- Commercial licensing is an area of investigation and development
ETSI 1st NFV Plugtest Scope

The Plugtest allowed to validate ETSI NFV Release 2 capabilities including the following areas:

- Virtual Network Function Package Management
- Software Image Management
- Network Service Descriptor Management
- Virtual Network Function Life Cycle Management
- Network Service Life Cycle Management

Participants of ETSI NFV PlugTest
## ETSI PlugTest Participants

<table>
<thead>
<tr>
<th>Organisation</th>
<th>VNFs</th>
<th>Organisation</th>
<th>MANOs</th>
<th>Organisation</th>
<th>VIM&amp;NFVI</th>
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<td>ADVA</td>
<td>Ensemble Orchestrator</td>
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**Source:** ETSI
## ETSI 1st NFV PlugTest Results

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<th>Test Group</th>
<th>Interoperability</th>
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<tr>
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Source: ETSI
Vendor
Interoperability
Building an interoperable application

Requires provision for...

- **Predictable characteristics**
  - Performance
  - Scalability
  - Operability

- **Lifecycle managed**
  - Upgradeable
  - Resilient
  - Consistently deployable

- **Interoperable**
  - Standard interfaces
  - Predictable characteristics
Vending an interoperable solution...

Expectations on the network are evolving:

- Click to buy... plug and play...
- Application portability
- Interoperable functions
- Multi-vendor solutions
- End to end automation
Harmonize
Harness
Consume
Concluding...

- Upgradability / Managing open source releases and branches

- What should/could open source projects do to minimize interop issues in commercialized implementations?

- What role should / must the operator play? How much control and responsibility is required today?

- What responsibilities should the vendor assume - including contributions to open source projects?