OPNFV

PLUGFEST REPORT

Results and Lessons from the Fourth OPNFV Plugfest (December 2017)

Please direct any questions to info@opnfv.org

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EXECUTIVE SUMMARY

The fourth OPNFV Plugfest was held in the Portland, Oregon area and was hosted by Intel® from December 4-8, 2017. The focus of this Plugfest was the OPNFV Euphrates release. It was attended by 104 people from 30 organizations that included 6 end-users and 6 non-member companies.

The Plugfest attendees had access to 14 PODs—6 on-site and the remaining offsite—from 8 organizations. Plugfest highlights included container orchestration, VNF onboarding, cross-community CI (XCI), the impact of noisy neighbors on performance, service function chaining (SFC), Intel Purley hardware (Intel® Xeon® Scalable Processors with Intel® C620 Series Chipsets) and Testing projects such as Dovetail, NFVbench, Yardstick, VSPERF and Storperf.

As with past Plugfests, there were hacking and planning sessions (or "Hackfest") around various OPNFV projects, especially testing projects. Additionally, a Hands-on Experience Sharing track was also conducted for those new to OPNFV, with a special emphasis on tutorials for deploying and testing OPNFV using all five installers included in the Euphrates release.

Both open source and commercial vendor solutions are welcome at OPNFV Plugfests, and this makes it an important event for the community to try new combinations of components. The presence of multiple project technical leads (PTLs) and key stakeholders made it very easy to solve problems and get feedback, and helped accelerate progress from what typically takes weeks into hours or days. The Plugfest gave end-users and vendors the ability to try new hardware, installers, scenarios, test cases and tools while coming together as a community and solving problems collaboratively.

LAB AND HARDWARE RESOURCES

Advantech, Intel and Nokia provided on-site dedicated hardware for the plugfest (hosted in the Intel OPNFV lab):

Advantech PAC-6009

Advantech PAC-6009 Carrier Grade Server for Virtual Service Edge:

- Advantech PAC-6009 Carrier Grade Server for Virtual Service Edge:
- 6U height blade server
- 2 hot-swappable CPU blades: control nodes
  - Single socket, 8 core, 64GB, 640GB SSD, 2x 10GbE, 2x 1GbE
- 7 hot-swappable CPU blades: compute nodes
  - 3 blades: single/dual socket, 8-32 core, 64-128GB memory, varying amounts of SSD storage, 2-4x 10GbE, 2-4x 1GbE (management)
- 2 switch modules
- Hot swappable and redundant AC/DC PSU
- Four rear pluggable, hot swappable fan modules with fan speed control
- Shelf management based on Advantech IPMI
- NEBS Level 3

Figure 1: Advantech PAC-6009

Intel

Intel Pharos PODs 12, 14, 19 and 20 co-located at the Plugfest venue were made available for use at the event. The Intel OPNFV lab has 12 PODs (over 70 servers) that are accessed remotely by the OPNFV community for development, integration, deployment and testing (https://wiki.opnfv.org/display/pharos/Intel+Lab)

POD 12 included the following hardware:

- 6 Intel white box servers
  - 2x Xeon E5-2699v4 @2.20GHz
  - 64GB memory
  - 180GB SSD and 3TB SATA HDD storage
  - 2x 10GbE, 2-4x 1GbE (management)
- IZ1 10GE SDN switch on IA platform, Extreme 480 1GE switch
- Ixia traffic generator connected to 3 nodes

POD 14 included the following hardware:

- 6 Intel white box servers
  - 2x Xeon E5-2699v4 @2.20GHz
  - 56-128GB memory
  - 880GB SSD storage
  - 2x 10GbE, 2x 1GbE (management)
- IZ1 10GE SDN switch on IA platform, Extreme 480 1GE switch

Figure 2: Intel Pharos PODs

PODs 19 and 20 are based on the latest Intel® Xeon® with Purley chipset and included the following hardware:

- 6 Intel white box servers
  - 2x Intel® Xeon® Gold 6138 Processor
  - 64GB memory
  - 190-200GB SSD, 3TB HDD storage
  - 2x 10GbE, 2x 1GbE (management)
- IZ1 10GE SDN switch on IA platform, Extreme 480 1GE switch

Nokia AirFrame Servers

Nokia AirFrame Open Rack Servers:

- 6x AirFrame OR nodes
- 1x AirFrame OR switch Z9100ON, 32x 100GbE
- 1x AirFrame OR switch S3048ON, 48x 1GbE
- 1x AirFrame OR PSU for power shelf with connectivity for Europe and North America
- 1x 20U Open Rack frame

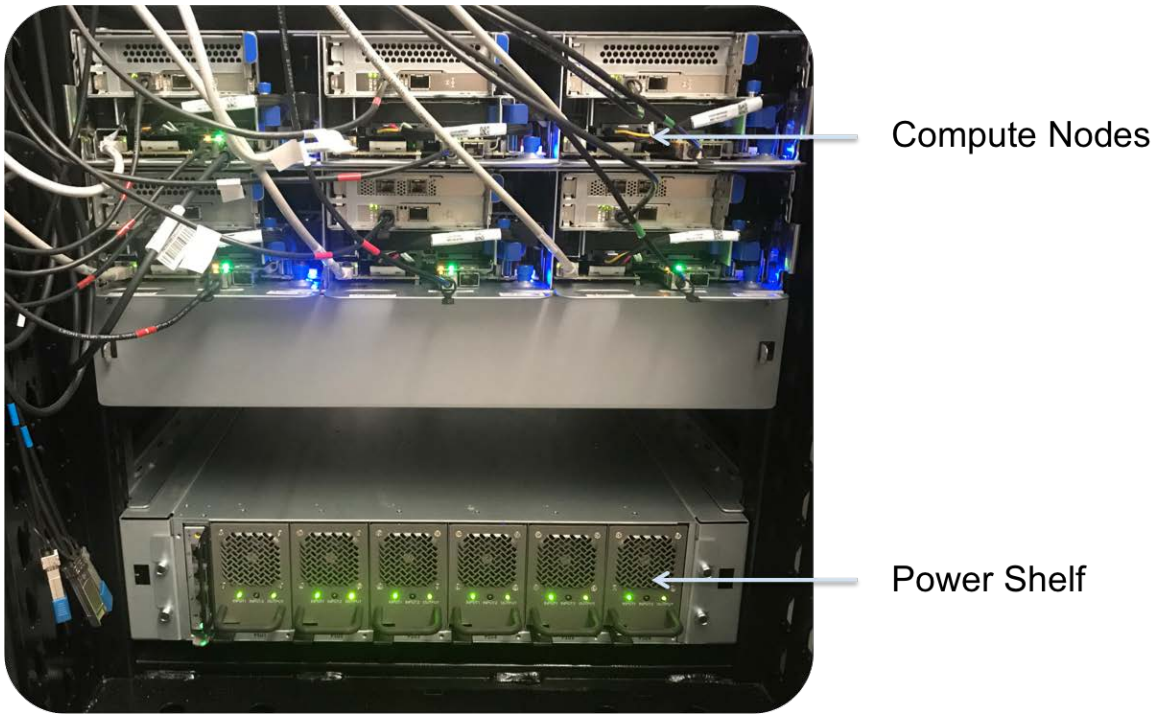


Figure 3: Nokia AirFrame servers

Additionally, several organizations provided dedicated hardware from remote locations:

Lenovo made three dedicated PODs available remotely from Research Triangle Park, North Carolina:

- GP POD: 1 System x3550 M5 rack server (jumphost) with HDD, 2x 10GbE, 4x 1GbE, 5x System x3550 M5 rack servers (compute + controller nodes) with 2x SSD, 6x HDD, 2x 10GbE, 4x 1GbE, 1 G8052 switch, 1 G8272 switch
- OCP POD1: 1 System x3550 M5 rack server (jumphost) with HDD, 2x 10GbE, 2x 1GbE, 5x OP@L OCP compute nodes (compute + controller nodes) with SSD, HDD, Mellanox 4x 25 GbE ports, 1 NE2572 switch
- OCP POD2: 1x System x3550 M5 rack server (jumphost) with HDD, 2x 10GbE, 2x 1GbE, 4x OP@L OCP compute nodes with SSD (compute + controller nodes), HDD, Mellanox 4x 25 GbE ports, 1 G8272 switch, 1 G8052 switch

NEC made one POD available from Tamagawa Lab, Japan:

- 2x jumphosts: HP ProLiant DL380, 2x E5-2650 8C/16T, 128GB memory, 4x 300GB HDD, 4x Broadcom 1GbE, 2x Intel Dual-port 10GbE
- 10x compute/controller nodes: NEC E120d-1 or NEC R120d1M or NEC R120g-2M servers with 4-24 cores, 32-160GB memory, 300GB-1.8TB HDD, 4-6x 1GbE to 2x 10GbE

Nokia made one POD available from Espoo, Finland:

- JumpHost: Nokia AirFrame Rackmount servers 1U, 4x 10GB, dual 10G LoM, HDD 1x 1TB, 128GB memory, E5-2630 v3 @ 2.40GHz
- 6x Compute/Controller Nodes: Nokia AirFrame Rackmount servers 1U, 4x 10GB, dual 10G LoM, HDD 1x 300 GB - 1TB, 128GB memory, E5-2630 v3 @ 2.40GHz
- Five Computes: Nokia AirFrame Rackmount servers 1U, 4x 10GB, dual 10G LoM, HDD 1x 1TB, 128GB memory, E5-2630 v3 @ 2.40GHz
- 1x AirFrame OR switch Z9100ON, 32x 100GbE
- 1x AirFrame OR switch S3048ON, 48x 1GbE

Additionally, a number of organizations opened up their lab resources for the plugfest (accessed remotely):

CENGN made 6 vPODs available from their lab in Ottawa, Canada based on the following hardware:

- 5 x Kontron MSP8040
  - 1x Intel Storage/Comms 16 Cores Xeon D-1545, 1.5 MB/core cache, 2.0 Ghz
  - 4x 8GB DDR4 Ram (32GB total)
  - 1x 128GB SSD
  - 2x 1TB HDD (SATA 7200rpm)
- 1 x SuperMicro X10DRT-P
  - 2x Core Intel 48 Cores Xeon E5-2670 v3 @ 2.3 Ghz
  - 8x 16GB DDR4 RAM
  - RAID1: 2x SSD 118GB
  - RAID5: 4x 446GB
  - LSI 3108 controller
  - 2x 10GbE

Cisco made a testbed available from San Jose, US:

- Cisco UCS-C240 controller
- Cisco UCS-B series rack with 8x UCS-B200 blades with 2x 10GbE

ENEA made an ARMv8 based POD available from Stockholm, Sweden (https://wiki.opnfv.org/display/pharos/Enea+Hosting).

ZTE made one POD available from Shanghai, China (https://wiki.opnfv.org/display/pharos/ZTE+Hosting).

PLUGFEST
TESTING ACTIVITIES

The main focus of the plugfest was to test various hardware and third-party software products against the latest Euphrates release.

The immediate availability of subject matter experts allowed for successful integration and productive (functional and performance) testing. The testing also uncovered several issues that have been or are being addressed. The table below provides a high-level testing summary:

Hardware	OPNFV Installer or Commercial Software	Notes
Advantech Server	Wind River Titanium Cloud	Dovetail, Functest, NFVbench, Storperf testing
CENGN	XCI	XCI stability and efficiency development and testing, XCI sandbox
ENEA	Fuel	Storperf testing
Intel		Spirent CloudStress, VSPERF testing to understand Last-Level Cache (LLC) impact for noisy neighbor scenarios
	Wind River Titanium Cloud	Dovetail, NFVbench, Spirent TestCenter Virtual, Spirent Metrics Service
	JOID	OpenContrail scenario, Kubernetes scenario, Functest, Yardstick
	Apex	ODL scenario testing
Lenovo	Apex	Functest, testing around pod descriptor file (PDF) and installer descriptor file (IDF)
	JOID	Functest, Kubernetes scenario testing, Yardstick; prepared POD for ETSI plugfest
	Wind River Titanium Cloud	Dovetail, Functest, NFVbench
NEC	Apex	SFC and Doctor testing using Functest within ODL+SFC deploy scenario
Nokia	Apex	Radisys vMRF VNF onboarding and testing; Functest.
		Telco Host Scheduled Maintenance. POC as base for new Doctor test case
	Fuel	Deployment testing
Cisco	Apex	NFVbench with the OPNFV FastDataStack and the ML2/VPP Neutron plugin

Table 1: Summary of Testing Activities

Some specific focus areas were container orchestration with OPNFV, VNF onboarding, Dovetail testing, cross-community CI (XCI), noisy neighbor testing, NFVbench testing, infrastructure descriptor files, SFC testing and Storperf testing.

Container Orchestration with OPNFV

Containerized VNFs provide up to 10x density on a given node and boot up 10x faster as compared to virtual machine (VM) VNFs. Given this benefit, containerized VNFs are anticipated to become increasingly popular. Kubernetes appears to be the de-facto virtualized infrastructure manager (VIM) aka container orchestration engine (COE) of choice for containerized VNFs. For these reasons, community members tested a scenario from the Euphrates release against both Intel and Lenovo hardware.[1]

VNF Onboarding

VNF onboarding consistently ranks as one of the more popular use cases for OPNFV. During this plugfest, Radisys onboarded their virtual Media Resource Function (vMRF) VNF on OPNFV using the Nokia onsite POD using the Apex installer.

The vMRF is a key component of a virtual IP multimedia system (vIMS) service. The vMRF supports many functions such as tones, announcements, three-way calling and transcoding and enables services such as voice-over-LTE (VoLTE), voice-over-WiFi (VoWiFi), video conferencing and web real-time communication (WebRTC).

The process of onboarding involved translating the TOSCA VNF descriptor into the OpenStack Heat format, and then using the Heat template to import and deploy the vMRF qcow2 image. Once the vMRF VNF was onboarded onto OPNFV, it passed verification through console checks, loading of license and basic configurations, and preliminary SIP testing.

Dovetail Testing (OPNFV Verified Program)

The Dovetail project provides a suite of compliance tests, intended to validate that a commercial VIM + NFV infrastructure matches the baseline capabilities of OPNFV and certain optional features. Dovetail forms the basis of the OPNFV Verified Program (OVP) and was tested successfully by multiple teams.

Cross-community CI (XCI) Testing

The XCI project regularly integrates the latest code from select upstream projects such as OpenDaylight, OpenStack and FD.io into OPNFV, slashing the time to implement new features and address bugs from months to days. Along with the XCI project, there is

[1] Containers came up in a different context during the Hackfest portion of the event—as a mechanism to deploy and manage the lifecycle of the underlying VIM and SDN controller components using projects such as OpenStack Kolla. See Hackfest section for more details.

also an XCI Sandbox that allows developers/testers to set up a scenario with the latest upstream code. During the plugfest, the community members used the CENGN vPODs to work on improving the stability and efficiency of XCI. There was work done on utilizing PDF and IDF to enable XCI Sandbox to deploy on different types of PODs—virtual and physical. Additionally, there was also work done on predictably re-deploying (replaying) past deployments.

Additional OPNFV Test Activities

NFVbench Testing

Euphrates includes the first version of NFVbench—an end-to-end dataplane benchmarking framework project. Currently it evaluates 8 metrics and includes the open source TRex traffic generator. NFVbench was tested against Wind River Titanium Cloud on three hardware platforms: Advantech, Intel and Lenovo and against the FastDataStacks on Cisco UCS-B with the ML2/VPP plugin.

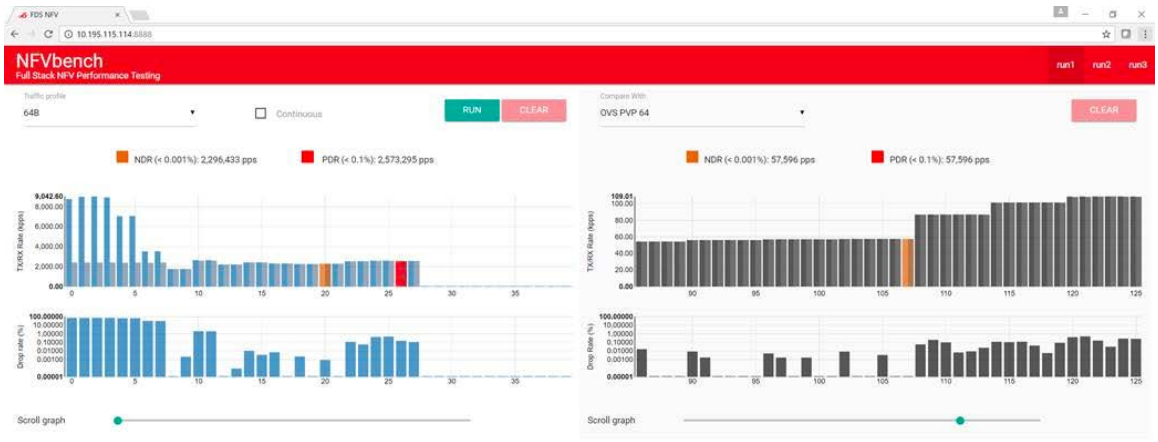


Figure 5: NFVbench End-to-end Dataplane Performance Benchmarking Project Screenshot

PDF/IDF/SDF Testing

The community has been working on three types of descriptor files:

- POD descriptor file (PDF)
- Installer descriptor file (IDF)
- Scenario descriptor file (SDF)

The standardization of these three files will allow the CI pipeline to deploy scenarios in a more dynamic way by matching the needs of a scenario to the capabilities provided by a POD and an installer. This feature will help overcome the current limitation where

a scenario is tied to specific POD(s), which in turn limits hardware resource utilization. Another added bonus of these descriptors is the ability to support non-standard hardware such as traffic generators, specific NICs etc.

SFC Testing
The OpenStack + OpenDaylight + Service Function Chaining (SFC) scenario was tested on the NEC POD against Functest. The team also deployed an L2 gateway manually, an OPNFV roadmap feature.

Storperf Testing
The external block storage performance test project, Storperf, was run on an OPNFV Fuel scenario and Wind River Titanium Cloud on an ENEA POD and Advantech server.

Other Testing
Functest, the OPNFV functional testing project, and Yardstick, a performance testing project, were run on a number of scenarios and hardware platforms for baseline validation. The Doctor test case in Functest was run on NEC POD.

In one specific case, after Functest was run on the Lenovo hardware using the JOID scenario, the POD was further prepared for the “2nd NFV PLUGTESTS” event conducted by ETSI from January 15-19. Finally, the Wind River Titanium Cloud team tested with Spirent TestCenter Virtual solution and Spirent Metrics Service focused on understanding lifecycle management of a VNF. The testing included instantiation, termination of a VNF, state management, scaling up/down or in/out.

HACKFEST

The Hackfest portion of the event had multiple parallel tracks. The sessions consisted of design summit like presentations and discussions. The key activity areas were as follows.

- Test project discussions and planning:
  - The attendees discussed characterizing dataplane performance for NFVI and VNFs by using Yardstick, VSPERF, NVFbench, Bottlenecks, and Barometer projects. There was also discussion on improved collaboration to eliminate duplicate work and share code/best practices.
  - OVP and Dovetail planning session explained an overview of the OVP process and mandatory vs. optional tests. There was additional discussion on future directions with respect to performance testing, improving current test suites, Kubernetes testing, VNF testing, supporting specific use cases, and HA test cases.
  - There was discussion on OPNFV contributing specific test cases for the combined ETSI/OPNFV plugfest in June. There are other collaboration opportunities with ETSI; specifically, to enhance Dovetail with ETSI test cases and helping edit ETSI test documents.
  - Almost all performance related test projects in OPNFV require traffic generators. There was productive discussion on creating traffic-generator-as-a-service that would allow multiple projects to use a common codebase, traffic profiles and dictionaries.
  - Over the last few releases, stress testing—the practice of pushing the OPNFV stack beyond normal parameters to study its behavior and failure modes—is becoming more popular. During the plugfest, attendees worked on a more precise definition of stress testing and compared and contrasted it with other categories of testing: long duration, load, robustness, reliability, availability, resilience and stability.
  - There was discussion around HA test cases and how to overcome infrastructure resource constraints that have so far stymied this effort. The group also discussed collaboration with the upstream OpenStack Masakari (Instances High Availability Service) project.

- There was a discussion session on users, common interfaces/services, GUI, and post processing analysis for benchmarking-as-a-service.
- Several projects such as Yardstick, Bottlenecks, VSPERF, Snaps-OO (an object-oriented API layer on top of OpenStack APIs integrated with Functest) conducted Fraser release planning sessions.
- The overall testing priorities in the next OPNFV Fraser release were discussed as projects often share test databases, report databases, and dashboards. There was interest in long duration and stability testing,

• A number of installer, CI and feature projects conducted planning discussions:

- Containerization of OpenStack was a popular topic. CableLabs discussed how they use Ansible and OpenStack Kolla (containerization of OpenStack services) internally for specific test cases. There was also a discussion on best practice and learnings from Daisy around Kolla. The goal of these discussions was to investigate if there is a role for Kolla in the XCI project. Separately, there was a discussion on using OpenStack Kuryr and OpenDaylight to provide a common networking layer across virtual machines and containers.
- The Daisy team discussed best practices and conducted Fraser release planning. For the upcoming release, features such as DPDK, Kubernetes, and Kubernetes Yardstick testing were discussed.
- The OPNFV Doctor project (service assurance) team discussed a telco host scheduled maintenance process. Using this process, CSPs can maintain network service availability even while performing maintenance (e.g. upgrade) on the underlying infrastructure. This process will eventually be turned into a test case for Doctor. The Doctor team also conducted a planning session for their future roadmap that includes VNF testcase improvements.

• Several process and community focused items were discussed and resolved:

- Today there are more than 60 scenarios (combinations of specific software components) in OPNFV. Increasing the the number of scenarios puts a huge strain on CI resources and so the community is always looking for ways to prune this number. The pros and cons of a proposal, where multiple non-conflicting features can be collapsed into one scenario, were discussed.
- Currently, end users trying out OPNFV do not have clear guidance on how to choose between multiple support avenues e.g. the mailing list, ask.opnfv.org or IRC. New messaging on the website is being considered to provide clear guidance on this topic.
- Documentation is a critical part of OPNFV. The attendees discussed documentation

improvements, tools, best practices and the most efficient way to get documents translated to other languages such as Japanese.

- There were several release planning discussions such as supporting out-of-cycle releases for projects (e.g. Calipso) not coupled to the broader release, improvements in the docker infrastructure and build automation, tooling and dashboards.
- The topic of transitioning to fully merit based Technical Steering Committee (TSC) elections was also discussed.

HANDS-ON
EXPERIENCE SHARING

The Hands-on Experience Sharing sessions, introduced for the first time at an OPNFV Plugfest, provided valuable information to those that might be new to OPNFV. The key sessions were:

Installers demos: Every installer in the Euphrates release namely Apex, Compass, Daisy, Fuel and JOID provided hands-on sessions where the speakers presented the entire deployment process and how to test the scenario to ensure the deployment was successful. These sessions were extremely popular, routinely running over the allotted time due to the number of questions.

China Mobile CI: China Mobile gave an overview of how their entire SDN/NFV deployment is partitioned into individual clouds called Telecom Integrated Clouds (TICs). Like any large operator, China Mobile uses a heterogeneous set of vendors. This results in different flavors of clouds and different integration efforts for each flavor. With manual integration taking roughly 6 weeks, there was a need for automation. The presentation described how Yardstick, elements of the OPNFV CI pipeline, and Compass4NFV were used to automate the integration task slashing the time required to just over 2 hours.

Introductory sessions: Various speakers provided an overview of:

- Euphrates Kubernetes scenarios
- XCI
- NFVbench
- VNF characterization using Yardstick
- Open Data Center Committee (ODCC) Scorpio and Open Telecom IT Infrastructure (OTII), 2 open source hardware projects emerging from China. China Mobile discussed how they have deployed OPNFV on ODCC Scorpio. They also covered how they are solving the issues with pre-integration (of VNFs etc.) in China Mobile's NFV trial.

ONAP: Orange provided an overview of ONAP, the two deployment options in the Amsterdam release—OpenStack Heat and Kubernetes OOM (in either option, the actual orchestration of VNFs is on OpenStack)—and discussed adopting the best practices of OPNFV CI for ONAP and potentially using XCI to provide ONAP with the latest OPNFV scenarios. The presentation ended with a demo of ONAP, OOM, and OPNFV.

BUGS / ISSUES REPORTED

Many problems arise from specific combinations of technologies in a plugfest environment. Here is a brief summary of bugs or issues that were found and are being addressed:

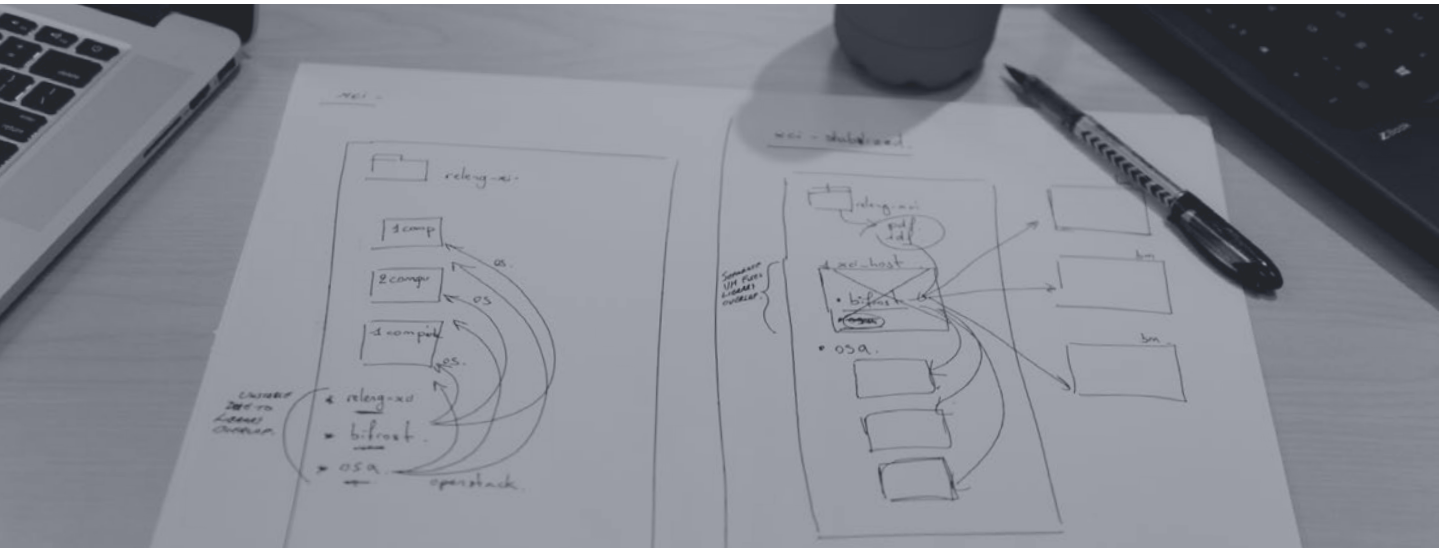
Project	Types of issues
Apex	Lack of kernel support for Purley in RHEL, enhancement request for virtual deployments to remove physical NIC requirement on Jumphost (APEX-557), user guide had invalid password for login (#48737)
Dovetail	OVP reporting issue, giving a false positive
Fuel	Public netmask is hard set to /24 MaaS PXE network is not read from PDF
Functest	Sanity test failing in combination with live migration, SFC scenario failure (two issues have been fixed by including the fix #46239 into the stable functest container image and APEX-558, remaining issues will be identified by further debugging)
NFVbench	Reporting issue, compatibility problem with CentOS guest, port security expectation problem, option to enable software mode to calculate RX packet stats is missing, NIC driver does not support retrieval of RX packet stats for the Advantech testbed NIC
OpenContrail	Driver compile issue with Ubuntu 16.04.3 LTS
OpenStack Nova	Failure when using AntiAffinity and migration together
Storperf	Output YAML file issue, problems supporting ARM containers

Table 2: Bugs / Issues Reported

PLUGFEST PARTICIPANTS

The following companies participated in the fourth OPNFV Plugfest. Many thanks to all the participants and the host, Intel, who helped make the event a huge success.

Name	Description	URL
Aarna Networks	Services and products around OPNFV and ONAP	aarnanetworks.com
Advantech	Embedded and automation products and solutions	advantech.com
ARM	CPU architecture provider	arm.com
AT&T	Telecommunications service provider	att.com
BytesRack Hosting	Web hosting provider	bytesrack.com
CableLabs	Nonprofit R&D consortium for cable providers	cablelabs.com
Canonical	Producer of Cloud platform Ubuntu and associated commercial services on various cloud and container solutions.	canonical.com
CENGN	Nonprofit R&D consortium based in Canada focused on telecommunications	cengn.ca
China Mobile	Telecommunications service provider	www.chinamobileltd.com
Cisco	Communications and information technology product vendor	cisco.com
DOCOMO	Telecommunications service provider	nttdocomo.co.jp
ENEA	Information technology company	enea.com
Ericsson	Network equipment vendor providing communication technology and services	ericsson.com



Huawei	Networking and telecom equipment vendor	e.huawei.com/us
HyperHQ	On-demand container service provider	hyper.sh
Intel	Semiconductor and computing vendor	intel.com
Intracom Telecom	Telecommunication systems and solutions vendor	intracom-telecom.com
Lenovo	Provider of technology products and services	lenovo.com
The Linux Foundation	Non-profit organization that accelerates open technology development and commercial adoption	linuxfoundation.org
NEC	Provider of information technology services and products	nec.com
Nokia	Communications and information technology company	nokia.com
Orange	Telecommunications service provider	orange.com
Red Hat	Provider of open source solutions	redhat.com
Radisys	Provider of open telecom solutions	radisys.com
Quanta Cloud Technology	Global datacenter solution provider	qct.io
Spirent Communications	Leader in test and measurement solutions enabling datacenter, cloud and service providers	spirent.com/virtual
UNH-IOL	Independent Interoperability and conformance lab	iol.unh.edu
Wind River	Embedded and open source software	windriver.com
Zayo	Telecommunications service provider	zayo.com
ZTE	Telecommunications and information technology vendor	www.zte.com.cn/global

Table 3: Participating Organizations

CONCLUSION

This Plugfest, similar to previous ones, completed several important testing activities and discovered new issues that were or are currently being addressed. The co-located Hackfest and Hands-on Experience Sharing track also proved to be extremely useful for accelerating planning, decision making, and creating awareness amongst new users. The fact that community members had access to Project Technical Leads (PTLs) and key experts in the same facility contributed to broad collaboration and rapid progress in many projects.

ETSI will be hosting OPNFV at their facilities in Sophia Antipolis for a co-located Plugfest June 4-8, 2018. The focus of this plugfest will be the OPNFV Fraser release. Announcements on this and future Plugfests will be made on the opnfv-tech-discuss mailing list. Information on future Plugfest planning meetings will be available at wiki.opnfv.org/display/EVNT/Plugfest. The planning meetings are open to everyone regardless of membership status, and we encourage everyone in the community to attend and participate.