PLUGFEST REPORT

Results and Lessons from the Third OPNFV Plugfest (April 2017)

Please direct any questions to info@opnfv.org

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EXECUTIVE SUMMARY

The third OPNFV Plugfest was held in Paris and was hosted by Orange from April 24-28, 2017. The focus of this Plugfest was around the OPNFV Danube release. It was attended by 87 people from 29 organizations that included 6 end users and 6 non-member companies. Orange's detailed planning, a warm welcome, large meeting area and a kick-off by Ms. Jehanne Savi, All-IP Strategic Program Executive at Orange, got things off to a promising start.

The Plugfest attendees had access to four hardware platforms on-site and additional off-site hardware from 7 organizations. A key accomplishment for the Plugfest was the integration of several MANO software stacks: ONAP, OpenBaton, and ZTE's commercial product—vManager. In some cases, VNFs were also included to form a full NFV stack. Additionally, the Plugfest provided impetus to the Dovetail, VSperf, QTIP, power-as-a-service and Yardstick test projects, as tests were executed against new combinations of hardware and software, or entirely new test cases were tried out. Moreover, testing was conducted around two dataplane acceleration technologies, the OPNFV Moon project and multi-region deployments. As anticipated, a large number of issues were discovered that are in the process of being resolved.

A hackfest was also co-located with the Plugfest. Dovetail, testing and infra projects had in-depth face-to-face discussions resulting in detailed planning and key decisions. The fact that the OPNFV Hackfest had parallel tracks allowed for simultaneous progress across multiple fronts.

Both open source and commercial vendor solutions are welcome at OPNFV Plugfests, and this makes it an important event for the community to try 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 compress weeks or months of progress into days. In summary, 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

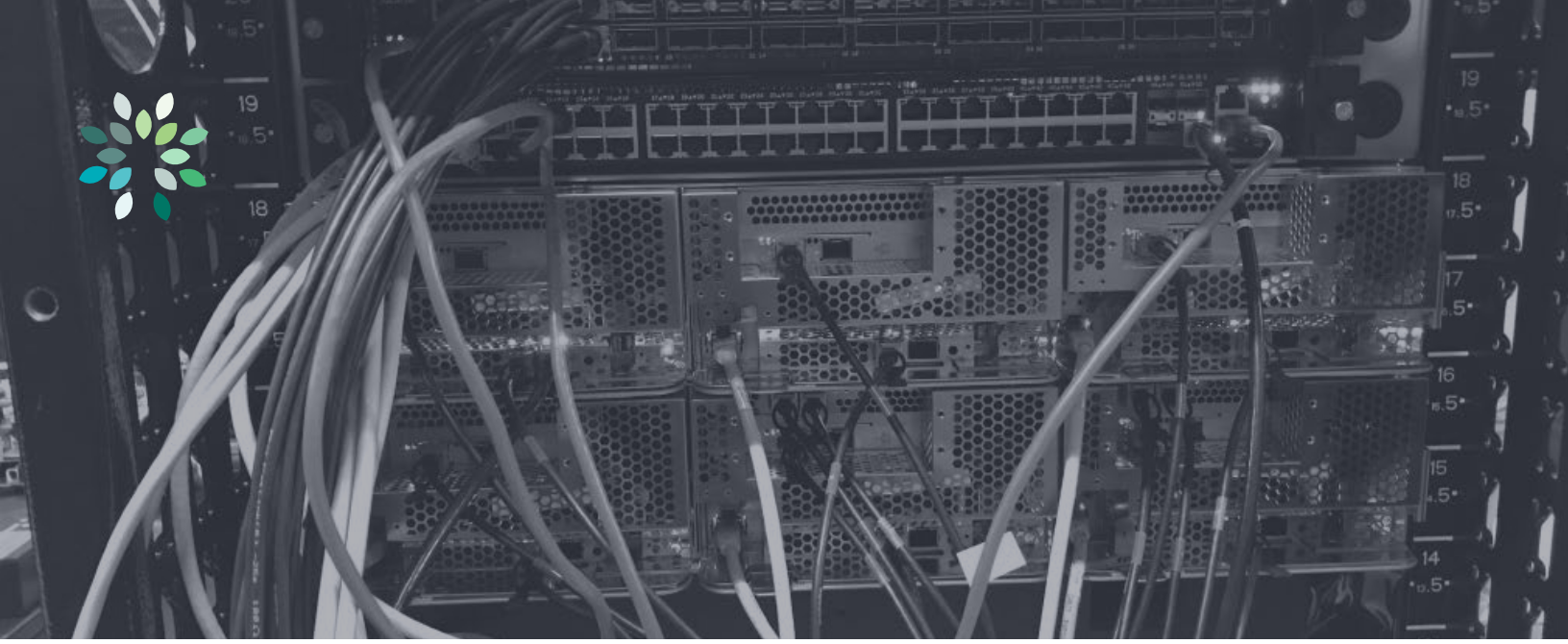
Advantech, Huawei, Nokia and Orange provided on-site dedicated hardware for the plugfest:

Advantech PAC-6009

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-609



Advantech FWA-1010VC

Two desktop units of Advantech FWA-1010VC Universal CPE device for veCPE and SDWAN:

- 4 core Intel C2558 with QAT acceleration
- 16GB memory
- 128GB M.2 and 240GB SSD

Figure 2: Advantech FWA-1010VC

Dell PowerEdge 730

The Orange Pharos POD co-located with the Plugfest was made available:

- 5 Dell PowerEdge 730 rack servers
  - 2x Xeon E5-2603 (1.6GHz, 15M cache) or E5-2699 (2.3GHz, 45M cache)
  - 2x Intel SSD DC S3500 480GB
  - 4x 10GbE, 4x 1GbE
- EX 4550, 32-port 100M/1G/10G switch

Figure 3: Orange Pharos POD

Huawei E9000

Huawei E9000 Converged Architecture Blade Server:

- 1x backplane subrack, 12U high-powered integrative module
- 2x CX915, 4x 10GbE, 12x GE, 8x 8Gbps FC Port, switch module
- 2x CX310, 16x 10GbE converged switch module
- 8x Compute Node, CH121 V3
  - 2x Haswell EP Xeon E5-2683 v3, 14 core
  - 384GB memory
  - 2TB HDD

Figure 4: Huawei E9000

Nokia AirFrame Servers

Nokia AirFrame Open Rack Servers:

- 6x AirFrame OR nodes (3 control, 2 compute, and one jumphost)
- 1x AirFrame OR switch Z9100ON, 32x 100GbE
- 1x AirFrame OR switch S3048ON, 48x 1GbE
- 1x AirFrame OR PSU for power shelf
- 1x 20U Open Rack frame

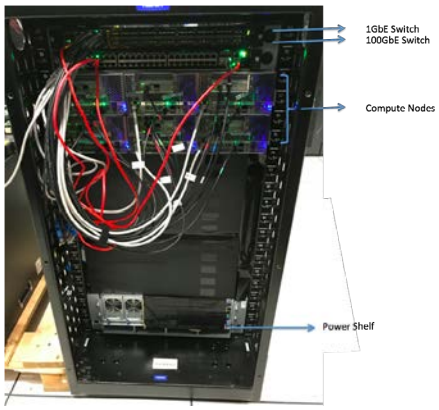


Figure 5: Nokia AirFrame servers

Additionally, a significant amount of hardware was made available remotely:

CENGN Pharos Lab: One POD was made available from their lab (https://wiki.opnfv.org/display/pharos/CENGN+Hosting).

ENEA Pharos Lab: An ARMv8 based POD was made available (https://wiki.opnfv.org/display/pharos/Enea-pharos-lab).

Intel Pharos Lab: Four PODs were made available from Hillsboro, Oregon (https://wiki.opnfv.org/display/pharos/Intel+Hosting).

Lenovo made three dedicated PODs available remotely from RTP, North Carolina:

- GP POD: 1 System x3550 M5 rack server (jumphost) with HDD, 2x 10GbE, 4x 1GbE, 5x System x3650 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 G8272 switch, 1x 24GbE ToR 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 two interconnected PODs available from Germany (https://wiki.opnfv.org/display/EVNT/NEC+Danube-Plugfest):

- 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

Orange Pharos Lab: In addition to the on-site Orange POD above, the remote POD2 in Lannion was also made available (https://wiki.opnfv.org/display/EVNT/Orange+Danube-Plugfest).

ZTE Pharos Lab: POD1 from their Pharos Lab was made available (https://wiki.opnfv.org/display/pharos/ZTE+SH+Testlab).

NOKIA POD from Espoo, Finland

- JumpHost: Nokia AirFrame Rackmount servers 1U, 4x 10GB, dual 10G LoM, HDD 1x 1TB, 128GB memory, E5-2630 v3 @ 2.40GHz
- One Controller: Nokia AirFrame Rackmount servers 1U, 4x 10GB, dual 10G LoM, HDD 1x 300 GB, 1x 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

Connectivity

Plugfest attendees were able to access both local and remote PODs from the meeting rooms. Local PODs were connected to a datacenter in an adjacent building through dedicated high-speed networks. Remote PODs were available through a firewall via OpenVPN.

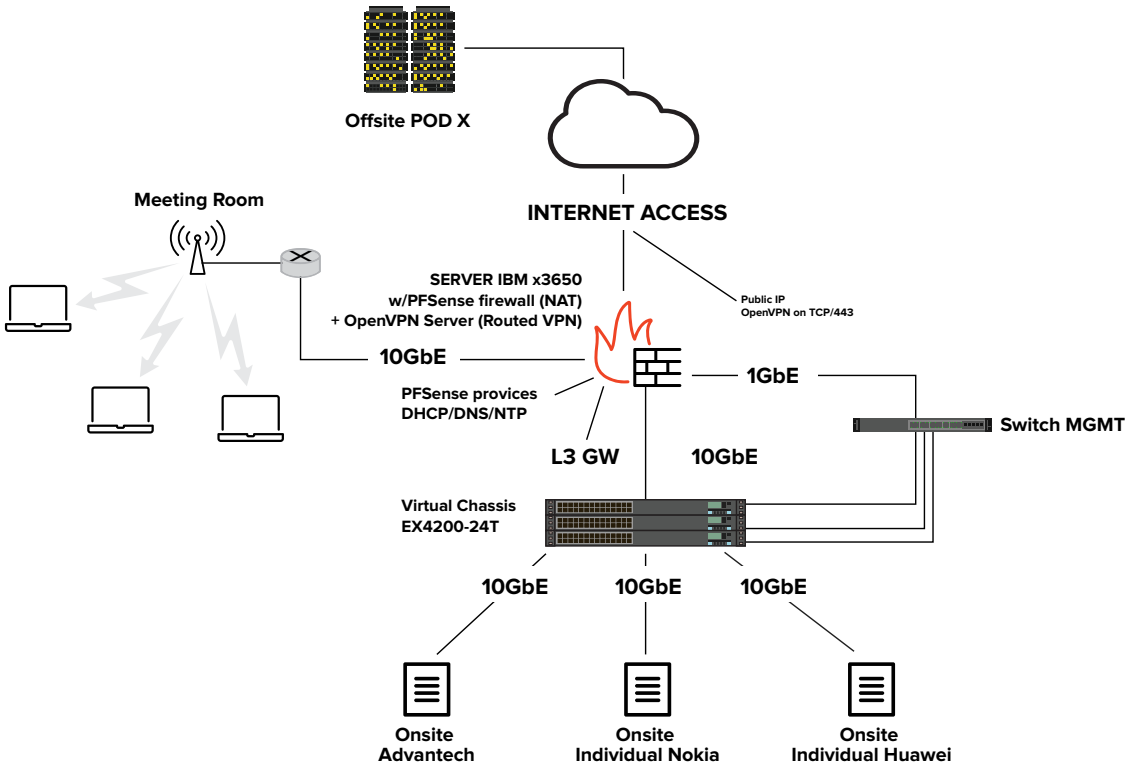


Figure 6: Simplified Plugfest Networks Configuration

PLUGFEST
TESTING ACTIVITIES

Testing at the Plugfest consisted of both pre-planned and ad-hoc activities. The immediate availability of subject matter experts allowed for successful integration and testing. The table below provides a high-level summary:

Hardware	OPNFV Installer or Commercial Software	Notes
Advantech Server	Compass	QTIP, Power-as-a-service
	Wind River Titanium Cloud / Fuel	Multiregion testing with Dovetail, Functest, Yardstick, Storperf (one region at a time)
	Apex	IPMI bridge integration for hardware control
Advantech Desktop	Brocade vRouter	Basic traffic test; no OPNFV integration
CENGN	JOID	Kubernetes scenario
ENEA	Fuel	QTIP, Power-as-a-service, SnapsOO
Huawei	Compass	Dovetail, Yardstick (with live migration), QTIP, Moon
	JOID	Dovetail
	Wind River Titanium Cloud	Dovetail, Yardstick
Intel	Fuel	VSperf, KVM4NFV
Lenovo	Apex	Dovetail, QTIP, Functest, SR-IOV
	JOID	Dovetail, QTIP, Functest, Yardstick, OpenBaton integration
	Wind River Titanium Cloud	Dovetail, Functest, Yardstick
NEC	Apex	Dovetail, QTIP, Functest, Doctor integration
	Fuel	Functest, QTIP, ONAP integration
Nokia	Apex	Dovetail, OVS-DPDK, Netronome (iPerf), Power-as-a-service, SnapsOO, FuncTest
Orange	Compass	QTIP, scale testing – adding node to POD
	JOID	QTIP, Functest with virtual jumphost, Virtual Ixia / vIMS testing
ZTE	Fuel	Full commercial + OPNFV stack, QTIP

Table 1: Summary of Testing Activities

MANO & Full Stack Testing

The Danube release is the first release that has integrated an open source MANO project: Open-O. Since then, Open-O has merged with AT&T's ECOMP project to form the Open Network Automation Platform (ONAP) project. Since ONAP is materially different from Open-O, there was interest in demonstrating ONAP integration. The current release of ONAP (essentially Open ECOMP) was successfully deployed on OPNFV Danube using an NEC POD with the Fuel installer. The team also got an opportunity to review results from an ONAP deployment on RackSpace's public cloud (based on OpenStack) and to consider issues common to both ONAP and OPNFV such as policy and security.

OpenBaton, a MANO project started by Fraunhofer Fokus, the largest research group in Germany, was also successfully deployed on the Lenovo OCP POD using the JOID installer.

ZTE integrated their commercial MANO and VNFs to demonstrate an end-to-end NFV stack. The full stack consisted of OPNFV Danube deployed on the ZTE POD by Fuel with ZTE MANO (vManager) and ZTE commercial VNFs for vIMS, vEPC and vHSS. After the full stack was deployed, a call was made using a SIP client on a laptop and a phone to test out the functionality.

Finally, with the goal of testing VNFs under load, the Clearwater vIMS VNF, easily deployable with Functest, was tested by generating traffic through a virtual Ixia load generator (IxLoad). The idea was to complete the existing signaling test suite with realistic load scenarios and study how to automate load testing. This testing also lays the groundwork for CI integration of the load generators in the OPNFV testing framework.

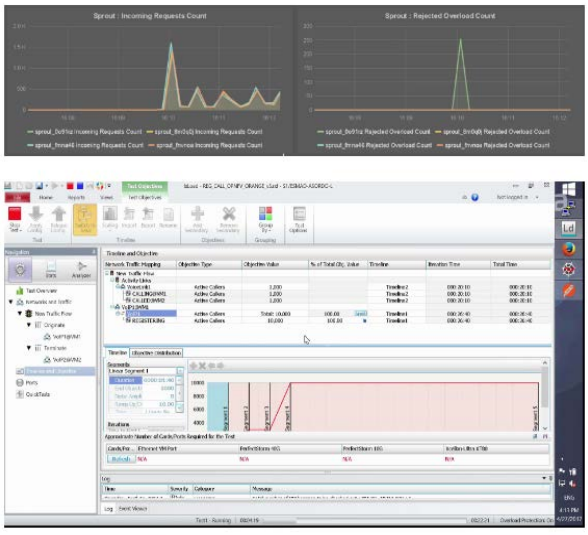


Figure 7: vIMS load testing results (top), tests ran (bottom)

Dovetail Testing

The Dovetail test suite forms the basis of the upcoming Compliance Verification Program (CVP) and is making good progress. This test suite at the Plugfest was a subset of tests used by the OPNFV community (specifically limited to OpenStack defcore and IPv6), and is meant to validate that a commercial NFVI+VIM product complies with a common baseline functionality found across OPNFV scenarios. The test suite was executed on three hardware platforms running OPNFV Danube, using four different installers. It was also run successfully against Wind River Titanium Cloud, a commercial NFVI + VIM product.

Performance and Throughput

Dataplane acceleration continues to be a vital area of interest for NFV. During the Plugfest, three different test efforts were completed. First, OVS-DPDK integration was successfully completed on a Danube scenario on Nokia hardware using the Apex installer. Second, Netronome's SmartNIC was integrated with the above Danube scenario using two different modes: SR-IOV with OVS offload, and SR-IOV direct pass-through with virtio-relay that does not require any guest OS driver changes. iPerf (an open source bandwidth measurement tool) and several Functest tests were run on this integration. Lastly KVM4NFV, deployed using Fuel on an Intel POD, was integrated with the open source Intel Dataplane Performance Demonstrators PROX, a tool that can be used for both traffic generation and synthetic VNF load generation.

Additional OPNFV Test Activities

VSperf
The VSperf testsuite, a Yardstick plugin, measures the performance of the virtual switch (OVS, VPP etc.) in NFVI. The VSperf team used four different traffic generators—Ixia (commercial), Spirent (commercial), Prox (open source), Moongen (open source)—that spanned implementations ranging from dedicated hardware, software traffic generator on bare metal server to software traffic generator in a virtual machine with SR-IOV enabled. VSperf tests were executed against two switch implementations: OVS and VPP, while using Spirent's commercial noisy neighbor stress generator.

QTIP
The QTIP project provides a single benchmark for NFVI compute (over time it will be extended to storage and networking). The QTIP team successfully ran their testsuite against six hardware platforms using four different OPNFV Danube installers.

Power-as-a-service
Power-as-a-service is an innovative new effort by Orange (not an OPNFV project yet) to measure the energy consumption of different scenarios and to characterize the power consumption of VNFs. The aim is to mirror the ease with which energy consumption of physical network functions can be measured today. The tooling consists of a docker

container with an Energy API, a Python data collector that polls servers using IPMI or RedFish API and a time-series database (InfluxDB). The tool also has a client component that integrates with Functest to cross-reference energy consumption against scenarios and tests.

Moon Security Project

The Moon project is in the process of working with the upstream projects Keystone and Congress (in OpenStack) and AAA (in Open Daylight) to improve the isolation, protection and interaction between VNFs. It identifies gaps in upstream projects and contributes features around authorization, logging, network enforcement, storage enforcement and so on. At the Plugfest, the Moon team created a multi-region deployment with regions connected by a private overlay network across two PODs. The goal was to create two keystone instances; a centralized master and a slave. Both the master and slave Keystone instances were set up in the two regions and were synchronized successfully. The feature can be extended to multiple regions and is slated to go into the Euphrates release.

Multi-site

The community had made significant progress on multi-region deployments with heterogeneous NFVI/ VIM software during the last Plugfest. The team continued that work at this Plugfest where a Wind River Titanium Cloud region was connected to a region deployed using OPNFV Danube; and the two regions shared common OpenStack Keystone, Cinder and Glance services between them. Dovetail, Yardstick, Functest and Storperf tests were successfully executed against this environment, one region at a time.

Yardstick

A new Yardstick test was executed against a live migration test case. Yardstick measured the migration time and downtime with one VM being migrated. The VM was configured without any memory load and 50% memory load, and the OPNFV scenario was deployed twice, using two installers. The migration time increased with memory load as expected. Interestingly, the downtime was random and uncorrelated to the memory load. The testing also exposed systems limits that the community can address.

Other

The Doctor project was deployed and tested on the NEC hardware using a scenario deployed by Apex. And a Kubernetes scenario, deployed by JOID, was tested on the CENGN remote POD. Finally, the test framework and suite open sourced by CableLabs called SnapsOO was tested on a Nokia POD against an Apex deployed scenario. Functest has already integrated SnapsOO in Danube, and projects like Yardstick are considering doing the same in the future.

HACKFEST

The Hackfest portion of the event had multiple parallel tracks. The sessions consisted of design summit like presentations, discussions and actual coding. The key activity areas were:

Dovetail Planning

The Dovetail team continued their work on the test suite during the week. In addition, tooling, test selection process for future tests (since more tests will constantly get added), documentation requirements, process details and test result submission guidelines were discussed. The team made a conscious decision to limit the current Dovetail test suite to functional testing; performance, security, API compliance etc. are out-of-scope and are areas for future consideration.

There was also some introspection, where the team discussed the differences between conformance and compliance, and recognized that the scope and meaning of OPNFV compliance will evolve with with every release as the test suite becomes richer and more mature.

Test Working Group Planning

The test team used the plugfest as a forum to finalize Euphrates release requirements for Functest and Yardstick. The Yardstick team also reviewed three demos around Prox, Spirent commercial testing tools and Deutsche Telekom's performance requirements for vEPC. Next, based on community feedback, the QTIP team will consider whether they can weave Yardstick results into their benchmark.

There attendees collaborated on the test case catalog, test results landing page, the need for additional resources to build a stress/robustness tests for stable releases and the evolution towards pseudo micro-services to expose and consume specific test projects such as load generator, VNF onboarding, and so on.

The test team also agreed to have deeper collaboration with ETSI, especifically around ETSI GS NFV-TST008 “Network Functions Virtualisation (NFV); Testing; NFVI Compute and Network Metrics Specification”. The two organizations, OPNFV and ETSI are also looking at a potential joint Plugfest-PlugTest in the near future.

Infrastructure Working Group Planning

Attendees discussed the timeline that installer teams need to adhere to for a successful Euphrates release this fall. Six installer teams plan to be ready: Apex, Compass, Daisy, Fuel, and JOID for regular release scenarios; and Ansible for Cross Community CI (XCI) testing. These installers will support the OpenStack Ocata release.

There was also progress made on a number of other topics for the working group. The main topic was Dynamic CI, where the goal is to eliminate the current coupling between a POD and an installer. This tight coupling makes full utilization of all Pharos Lab resources difficult, since the CI system can only allocate certain scenarios to certain PODs. Three new descriptor files will be required to solve this: Scenario Descriptor File (SDF) that describes what resources the scenario needs, POD descriptor file (PDF) that describes what capabilities the POD offers and a Network Settings file.

There was also discussion around streamlining the number of scenarios and the process to approve new scenarios. Next, there were continued discussions on XCI, the Pharos Dashboard, a security check in the CI process for new patches and virtual jumphost capability for Euphrates. Additionally, there was a presentation on a VNF catalog created via an OPNFV intern project.

OpenRetriever Planning

The OPNFV OpenRetriever project works on container integration. The team conducted meetings around the induction of a new sub-project that will investigate a next-generation VIM scheduler.

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
Functest	Needs to work in offline mode, multiple issues with specific hardware/ installer combinations. Needs admin access to the deployment. Both issues are being addressed for Euphrates release.
QTIP	Missing packages, authentication problems, parsing and listing issues
Dovetail	Discovered issues on specific hardware / installer combinations
DPDK	Failure when no cores specified to pin to, using a NIC other than NIC#1 for admin network; inability to specify IPMI bridge/ target channel
ONAP	Specific combination of VIM, installer, ONAP; and networking issues
Storperf	UI related issue
Yardstick	Fixes needed for multi-region deployments
KVM4NFV	Discovered issues on specific hardware/ installer combinations
Glance v2	OpenStack Glance v2 issues with specific hardware

Table 2: Bugs & Issues

PLUGFEST PARTICIPANTS

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

Name	Description	URL
Aarna Networks	Services and products around OPNFV, CORD and ONAP	aarnanetworks.com
Advantech	Embedded and automation products and solutions	advantech.com
AQSACOM	Lawful Interception and Legally Mandated Data Retention systems for communications services	aqsacom.com
AT&T	Telecommunications service provider	att.com
CableLabs	Nonprofit R&D consortium for cable providers	cablelabs.com
Canonical	Producer of Ubuntu and associated commercial services	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
Deutsche Telekom	Telecommunications service provider	telekom.com
ENEA	Information technology company	enea.com
Ericsson	Network equipment vendor providing communication technology and services	ericsson.com
ETSI	Creates standards for Information and Communications Technologies (ICT)	etsi.org
Huawei	Networking and telecom equipment vendor	huawei.com
Intel	Semiconductor and computing vendor	intel.com
Ixia	Provides visibility, test, security solutions across physical and virtual networks	ixiacom.com
The Linux Foundation	Non-profit organization that accelerates open technology development and commercial adoption	linuxfoundation.org
Mirantis	Managed services and software for open clouds	mirantis.com
NEC	Provider of information technology services and products	nec.com
Netronome	SmartNIC vendor	netronome.com

Table 3: Plugfest Participants

Name	Description	URL
Nokia	Communications and information technology company	nokia.com
Orange	Telecommunications service provider	orange.com
Red Hat	Provider of open source solutions	redhat.com
Spirent	Test and measurement solutions for telecommunication providers	spirent.com
Technische Universität Berlin	Technical University in Berlin	tu-berlin.de
T-Mobile Polska	Telecommunications service provider	t-mobile.pl
Virtual Open Systems	Virtualization software architecture and solution vendor	virtualopensystems.com
Wind River	Embedded and open source software	windriver.com
ZTE	Telecommunications and information technology vendor	www.zte.com.cn/global

Table 3: Plugfest Participants, cont.

CONCLUSION

Similar to previous Plugfests, this Plugfest resulted in several important activities being completed and issues discovered. The co-located Hackfest also proved to be extremely useful for project planning and decision making. The fact that community members had access to PTLs and key stakeholders in the same facility contributed to collaboration and rapid progress.

Announcements on future Plugfests will be made on the opnfv-tech-discuss mailing list: https://lists.opnfv.org/mailman/listinfo/opnfv-tech-discuss.

Information on future Plugfest planning meetings will be available at: https://wiki.opnfv.org/display/EVNT/Plugfest.

The planning meetings are open to everyone regardless of OPNFV membership status, and we encourage anyone in the community to attend and participate.