OpenAirInterface –An Upstream Project for OPNFV

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Abstract:

Current generation operators' networks are built on large number of proprietary hardware devices. As a result, it is becoming increasingly difficult for operators to roll out new services. New hardware requires space, which is compounded by the increasing costs of energy, capital investment, etc. In order to solve the emerging challenges for 5G, several operators, vendors, and IT service providers launched an Industry Specification Group (ISG) in ETSI called as ETSI NFV [1] to work on several aspects of Network Functions Virtualization (NFV). Several ETSI actors also decided to create an open source project with the Linux Foundation, OPNFV [2] with the goal to facilitate the development and evolution of NFV components through system level integration, deployment and testing. In this whitepaper, we present our views on how OpenAirInterface [5] can be used as a test VNF for OPNFV [2] for testing virtualized deployments for 3GPP cellular networks (eNodeB, EPC and UE).

Introduction:

Telecom networks contain large number of proprietary hardware appliances as shown in Fig. 1 (left-side of illustration). This creates lot of overhead in launching new services in terms of cost, additional space and power and also integrating new hardware into an existing network.

ETSI NFV aims to address this challenge by converging the telco and IT networks. It applies standard IT virtualization to consolidate network equipment types to standard high volume servers, switches and storage. NFV is highly complementary to Software Defined Networking (SDN) and can be easily used to manage NFV deployments. Fig. 1 describes the vision of ETSI NFV ISG.

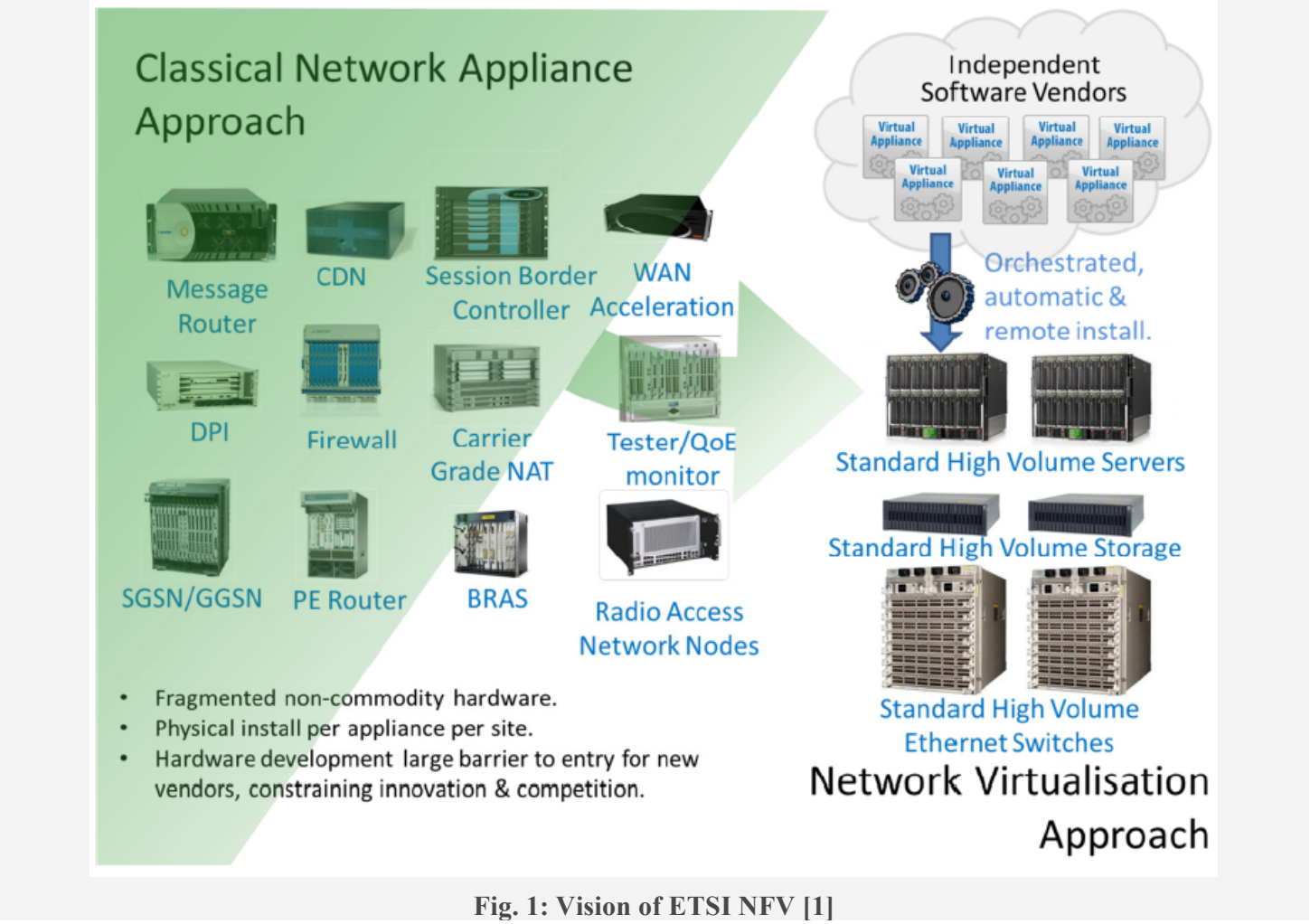


Fig. 1: Vision of ETSI NFV [1]

ETSI NFV also recognizes the role of open source on 5G, especially for managing cloud-based NFV deployments. In that spirit, some members of ETSI NFV ISG formed OPNFV [2] with the Linux Foundation to implement the concepts and standards proposed by ETSI NFV framework within the context of an open source project. OPNFV facilitates the development and evolution of NFV components across various open source ecosystems (such as OpenDaylight, OpenStack, KVM, LXD, etc). Through system level integration, deployment and testing, OPNFV creates a reference NFV platform to accelerate the transformation of enterprise and service provider networks.

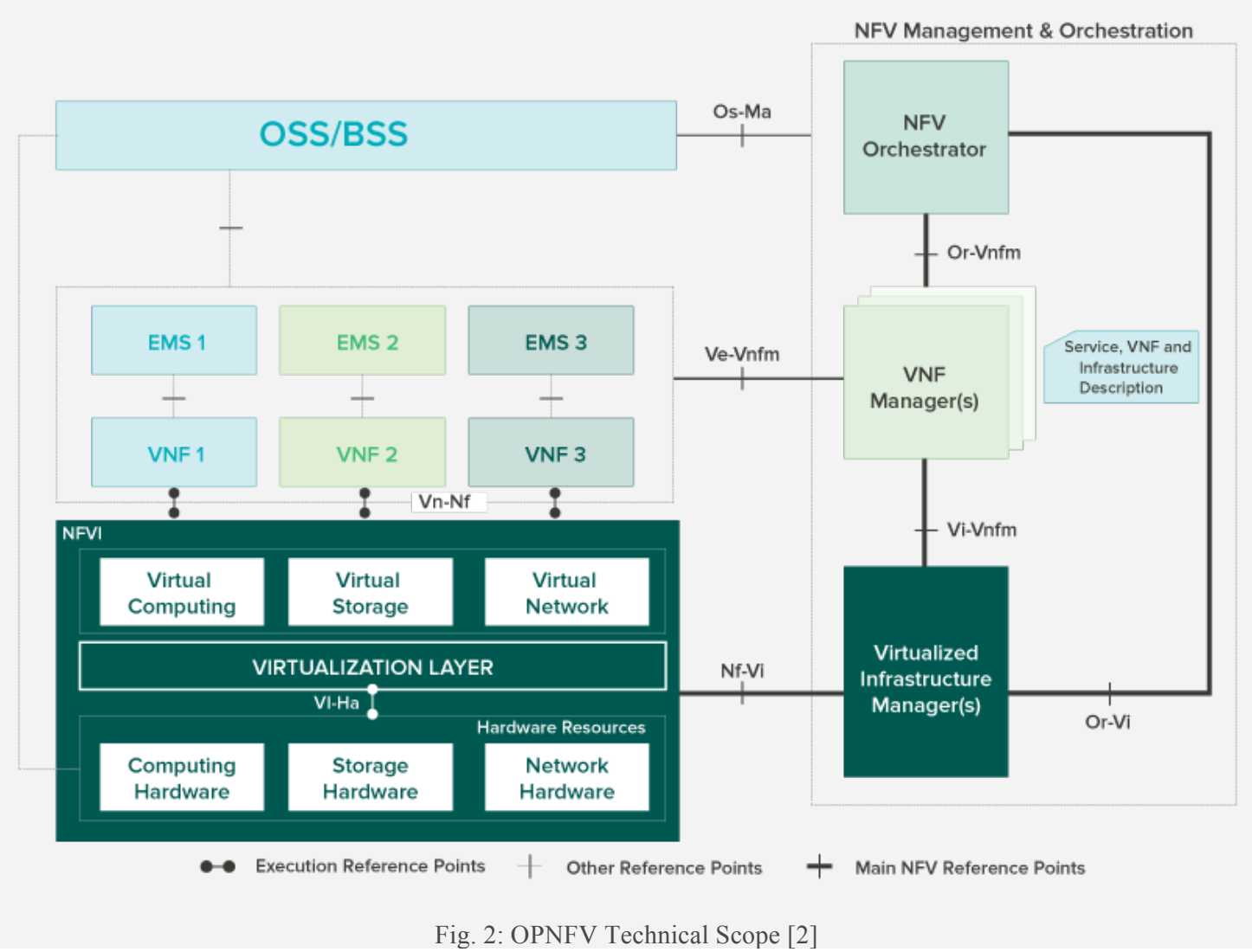


Fig. 2: OPNFV Technical Scope [2]

One of the main areas of focus of OPNFV is testing and integration of different upstream open source projects. Hence, OPNFV has several testing projects [2] around both functional and performance testing. One of the OPNFV projects, called Functest [3] focuses on functional testing of OPNFV infrastructure. The main goal of OPNFV functest project is to test the functionalities of OPNFV scenarios. The project develops test suites, test methodologies and platform configuration that is used by other OPNFV testing projects. The project is used to validate the scenarios for the release and is triggered across the federated OPNFV test lab infrastructure (Pharos project) [4].

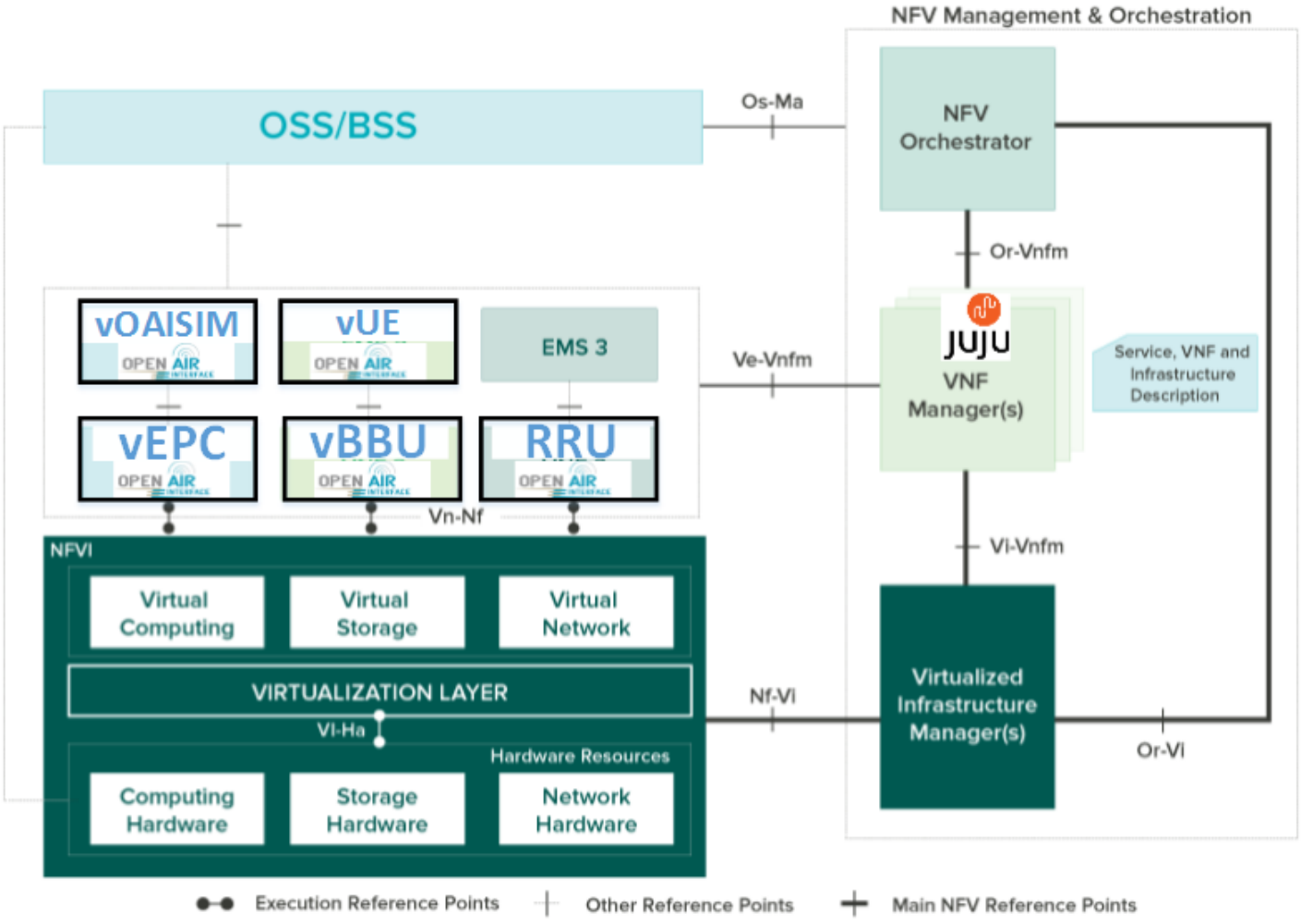
Introduction of OpenAirInterface as a VNF in OPNFV: A Platform for testing End-to-End 3GPP Cellular Networks

OpenAirInterface [5] is an open source Rel 8/Rel-10 3GPP compliant reference implementation of BBU, UE, RRH and EPC that runs on general purpose computing platform (Intel/ARM). The software can interface with commodity lab RF SDR platforms such as USRP B210 [12] for over-the-air (OTA) experiments with commercial devices. OpenAirInterface (OAI) offers the potential to test OPNFV

infrastructure within the framework of Functest project by offering several open source 3GPP 4G/5G VNFS, for example:

1. **EPC (HSS, MME, S/P GW)**
2. **Base Band Unit (BBU)**
3. **OAISIM: OAI Simulator for 3GPP RAN**
4. **Remote Radio Unit (RRU)**
5. **User Equipment (UE)**

The communication amongst the different VNFs within OpenAirInterface can happen over standard IP Communication interface thus avoiding the need of special purpose servers/RF equipment for testing OpenAirInterface. The current plan for OAI is to integrate OAI EPC as a VNF within OPNFV Functest as a part of Danube, the fourth OPNFV release. It should be noted that there is ongoing work within the OAI community towards disaggregating OAI EPC into (HSS, MME, S-GW, P-GW). This will enable all the different EPC components to run in their own virtual environments and be chained together with service orchestrator to provide EPC functionality dynamically based on network demand. RRU is a network element that interfaces directly with either commercial RF equipment (or in the case of OAI with general purpose SDR), and communicates with BBU over Optical/Ethernet Interface.



OAI Integration in the KVM4NFV Project

Core network virtualization is the starting point of RAN virtualization. Based on the research of C-RAN [9], RAN virtualization may make higher demand on computing capability, switching delay, down time of migration, etc. The OPNFV KVM project [13] also shows that the existing hypervisors are not necessarily designed or targeted to meet the requirements for the NFVI, and that performance optimization is needed to enable the NFV features. The current plan is to integrate OAI BBU as a VNF within OPNFV KVM performance test. Moreover, there are several shortcomings of the current fronthaul (FH) solutions for 5G, such as constant high bandwidth, fixed, one-to-one correspondence between RRH and BBU, etc. Therefore, a new FH interface called next-generation FH interface (NGFI) is proposed [10]. With the introduction of NGFI, the function split between BBU and RRH may be different according to the FH features and scenarios [11]. For vBBU VNF, the functions and features are also different according to the FH features and scenarios. So the next step is to design a flexible vBBU VNF based on NGFI.

OAI Integration in the Pharos Project

OPNFV created the Pharos project that deals with developing an OPNFV lab infrastructure that is geographically and technically diverse. This assists in developing a highly robust and stable OPNFV platform driven by community labs worldwide. The recent work started within OPNFV to integrate OAI as a VNF, managed by Juju based G-VNFM within Functest and KVM4NFV opens up interesting possibilities for further integration and testing within the Pharos test labs managed by OPNFV community. Depending on interest from the OPNFV community, OAI could possibly have an E2E solution involving orchestrator + G + OAI eNB + OAI UE all in software, where OAI eNB and OAI UE are connected via virtual interface streaming I/Q samples. OAI could also possibly bring real low-cost SDR like USRP and COTE Phone for automated testing of OAI-OPNFV deployments. This would allow the possibility of testing OPNFV infrastructure with OAI VNFs with real hardware and bring interesting 5G use cases into the framework.

Conclusion

We show in this whitepaper the initial progress around integrating OpenAirInterface within OPNFV. OPNFV aims to provide open source reference implementation of some of the key ETSI NFV concepts by integrating upstream projects such as OpenStack, OpenDaylight, KVM, etc. However, real-world VNFs are required for testing infrastructure. OpenAirInterface (OAI) can provide several interesting use cases around 4G/5G cellular deployment within OPNFV. The OAI community is also working towards creating SDN interfaces which can be leveraged for more complex test cases involving SDN controllers such as ODL [7], ONOS M-Cord [8]. The OAI Community also aims to work closely with ETSI NFV/ETSI MEC ISG, for example [6] in terms of providing PoCs demonstrating key

concepts of these work groups in collaboration with other partners. In the future, OAI imagines close collaboration between the OAI and OPNFV communities for joint demonstration and for working towards an end-to-end ETSI NFV platform based on open source tools. At the same time, OAI is working to further its core software for future 3GPP releases towards 5G. This allows OPNFV to leverage OAI as an upstream project for testing against cellular infrastructure. OAI testing within OPNFV Pharos Labs using OPNFV Functest also provides valuable feedback to the OAI community and we believe this collaboration is of great value to both the communities. OAI integration with OPNFV in conjunction with other open source projects has the potential to create an End-to-End reference platform built on open source software that can be potentially used by 3GPP/ETSI/NGMN for Proof-Of-Concept (PoC) and demonstration.

Statements from OpenAirInterface Members/Collaborators:

"We've been working on OPNFV for the past two years in order to consolidate the integration of open source components to build reference telco cloud solutions. To date, we've mainly focused on the infrastructure, but have achieved a maturity that allows us to go beyond the infrastructure and meet real, applicative telco needs. The integration of OAI in OPNFV will bring interesting new features and introduce 5G into the equation. It also illustrates the role of OPNFV in the ecosystem—leveraging all relevant upstream projects to define an efficient telco cloud." — Morgan Richomme, Orange

"We are pleased to have OAI as an upstream community and active collaborator. As the OAI PoC demonstration at the OPNFV Summit in Berlin showed, integration with the OPNFV JOID project allows OAI to run seamlessly on the OPNFV platform and integrate with third party VNFs. We look forward to continued collaboration on the road to 5G." — Heather Kirksey, OPNFV

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