SOLUTION BRIEF

Network Function Virtualization Promises More Agility at Lower Network Cost

Hewlett Packard Enterprise*, Intel®, and F5* partnered to develop virtualized network functions that run as fast as purpose-built hardware while providing true scalability and certified functionality.

"[D]elaying the decision to move to NFV, even by just a couple of years, can have dire consequences..."

ACG Research*, July 2015

Hewlett Packard Enterprise

Executive Overview

The rapid increase of mobile devices coupled with diminishing revenues due to competitive pressures cause communications service providers (CoSP) to rethink how they will grow their network into the future. In particular, scaling the network with commonly used, purpose-built hardware becomes cost-prohibitive within the competitive environment. Additionally, as competing cloud-based services become more agile, the challenges to operate a traditional, hardware-based network become daunting.

Now, providers embrace a path to virtualize their network functions. This concept of a virtualized network lowers both CapEx, by reducing hardware expenditures, and OpEx, by lowering power and space requirements as well as saving on hardware maintenance. According to a report by ACG Research[1], it is estimated that virtualization will lower both CapEx and OpEx by two-thirds. In addition, the report indicates that bringing innovative services to market can take less than 6 months with a virtualized network, contrasted to an average of 15 months for a traditional network.

Until recently, network functions virtualization (NFV) could not match the performance of hardware solutions. But that has changed, thanks to leadership from Hewlett Packard Enterprise* (HPE), Intel, and F5* Networks. In cooperation with the European Telecommunications Standards Institute* (ETSI) NFV Specifications, Intel developed an architecture augmented by HPE for commercial-off-the-shelf (COTS) hardware that can be used to run virtual network functions (VNF), such as those delivered by F5, at performance levels that continue to rival purpose-built hardware.

The Changing Network Business

Mobile network service providers face many challenges as they plan their needs for the future. One challenge involves coping with the massive increase in devices and applications, as well as competition from flexible, efficiently run cloud-based providers. The increase of mobile devices and their demand for data, especially streaming video, means that networks must grow rapidly. At the same time, the competition for users has negatively impacted revenue. Customers demand more for less and there seems to be no end to this trend. Network complexity becomes another challenge. Service providers deploy and manage different network components from multiple suppliers, and as they build these networks costs rise and network complexity increases. Controlling cost is a never-ending challenge.

Many network functions use purpose-built hardware primarily for its speed. With the speed and special purpose comes added costs. As user demands increase, more hardware is needed. The network is scalable, but the cost scales proportionately with the size and complexity of the network. And, scaling the network creates another problem: the network must by design handle peak demands, but in off-peak hours hardware can sit idle and generate no revenue.

Replacing purpose-built hardware, the NFV becomes more prevalent as service providers recognize the benefits from a virtualized network. Service providers can evolve their network architecture to a virtualized environment and realize NFV's value, including lowering network CapEx and OpEx, greater agility to more quickly roll out new services to market, and the flexibility to dynamically spin services up and down based on network and business demand.

The European Telecommunications Standards Institute (ETSI) undertook an effort to standardize NFVs with an Industry Specification Group to ensure all meet standard requirements. This is a major step in realizing full interoperability from best-in-class solutions across the network.

Fundamentally, NFV reduces network costs by virtualizing core network functions that are traditionally run on purpose-built hardware. The key to the cost savings involves migrating various network functions running on purpose-built hardware to COTS hardware. These Virtual Network Functions include many L4–L7 services, such as load balancing/application delivery, firewall, DNS, and policy management.

Just as critical as costs savings, NFV also offers a more agile and flexible network that enables service providers to innovate and introduce new services faster to market. NFV delivers tailored services and applications that closely align to subscribers' requirements. Services can spin up and down as needed.

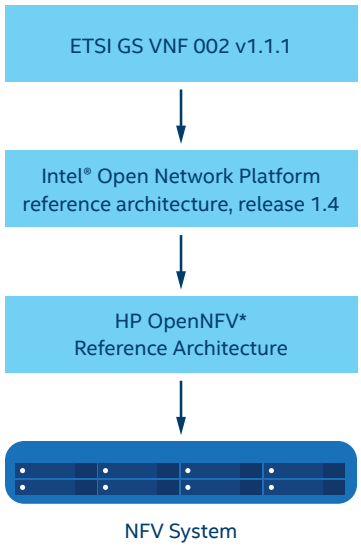

Figure 1: COTS server built to ETSI specification with Intel ONP, HP OpenNFV and F5 VNFs.

Ultimately, service provider networks will become fully virtualized. Most providers will require a hybrid network architecture that consists of both purpose-built hardware and virtual services on COTS hardware.

Virtual CPE

Virtual Customer Premise Equipment (vCPE) provides greater agility and lowers operational costs by enabling deployment for virtualized functions as a managed service. With vCPE, services such as Firewall Application Delivery Controller (vFW), Application Delivery Controller, and Domain Name System (vDNS) can deploy from the network. This flexibility allows dynamically chaining multiple services together, providing enterprise customers a service customized for their specific requirements. vCPE helps service providers to deploy new services faster to market while streamlining operations and processes.

The full portfolio of F5 VNFs along with the HPE NFV Director* management and orchestration system provides complete flexibility to dynamically spin services up and down in response to peak network utilization. Greater agility and velocity in delivering new applications and services improves the quality in the operator's experience.

Virtualized Solution Architecture

The response to each challenge described earlier provided by the combination of F5 VNFs, HPE NFV Director, and servers based on the Intel® Xeon® processor or Intel® Atom™ processor and Intel® XL710 or 82599 ethernet controllers. Service providers can deploy F5 VNFs in single sites and across multiple sites to provide services such as vCPE, where various network elements reside on premises, while the virtual components reside remotely in data centers. The standardized architecture guarantees that any ETSI-compliant NFVs will operate properly. *Figure 1* illustrates the architecture.

To ensure service availability and assurance, the partnership solution provides monitoring over the VNFs in the network. The HPE NFV Director can automatically configure and monitor the thresholds for F5 VNFs. It can also issue events or execute commands when crossing predefined thresholds. This ensures a highly available and scalable carrier-grade network that has

the agility and flexibility to launch new services with greater velocity that is typical of a virtualized network.

Transitioning the network will result in a period when there is a mix of purpose-built hardware and virtualized functions. The HPE NFV Director can concurrently manage and orchestrate both hardware based and virtual functions in a heterogeneous environment until the network becomes fully virtualized.

Using COTS hardware based on Intel® Architecture across the network provides a scalable, high-performance network without the need for more expensive purpose-built solutions. This use of COTS hardware also significantly reduces network complexity. This allows quick and easy deployment for network functions with faster innovation and increased revenue.

Ecosystem Collaboration Delivers Reliability and Performance

Intel is leading network transformation through open-source, open-standard technologies that form the building blocks for SDN and NFV. With Hewlett Packard Enterprise* as a technology partner, Intel collaborates with Intel® Network Builders members such as F5. This collaborative ecosystem enables an open, flexible environment for CoSPs to make the transition to NFV on the HPE NFVI platform, which includes Intel® Xeon® processors, a Data Plane Development Kit (DPDK) and key learning from Intel ONP reference architecture.

The Intel® Network Builders ecosystem working in collaboration with Intel and HPE provides CoSP's the resources to respond quickly to market demands while accelerating the overall transformation toward NFV. HPE's NFVI platform streamlines the design, proof-of-concept, trial, and deployment of new cloud-enabled network services and innovations, while lowering capital expenditures, operating expenditures, and risk. Intel plays a key contributor to the HPE OpenNFV* Lab testing, standards work, and the

NFVI platform's development. F5 is a OpenNFV partner who continues to work in HPE's labs.

F5 also works with Intel and HPE to help CoSP deliver commercial solutions targeting ETSI Network Function Virtualization use cases on the HPE Helion* OpenStack* Carrier Grade Platform. Further integrations will take place with Intel and open source communities such as OPNFV when those integrations meet the CoSP performance requirements.

Intel® Open Network Platform Reference Architecture

Intel developed an architecture platform based on the ETSI standards for NFV in an effort to accelerate development of commercial hardware and software platforms. The Intel® Open Network Platform (Intel® ONP) provides a reference architecture that redefines network architectures by decoupling the network functions from the hardware itself. This provides the Network Function Virtualization Infrastructure (NFVI) necessary to virtualize functions.

Intel ONP enables VIM and NFVI platform providers to more easily build solutions using open source software stack running on COTS servers for companies in telecom carrier networks, enterprise environments and cloud data centers. With the Intel ONP reference architecture, solution providers can plan, evaluate, and benchmark designs in advance for NFV deployments.

NFV Proof of Concept Certified by ETSI

Telstra*, Hewlett Packard Enterprise*, F5 Networks*, and Nuage Networks* demonstrated a Networks Functions Virtualization (NFV) proof of concept (PoC) solution that has been certified by the European Telecommunications Standards Institute* (ETSI) in October 2015 at the SDN and OpenFlow World Congress* in Düsseldorf, Germany. The four companies collaborated to design the PoC to demonstrate a multi-vendor NFV solution. The project, ETSI PoC #38, includes the HPE Helion CloudSystem* framework with F5 VNFs plus Nuage Networks virtual services platform. Telstra, Australian's largest telecommunications and media company, tested the solution on its network.

F5's VNF Portfolio

F5 develops carrier-grade solutions to meet the specialized needs of communication service providers (CoSP), supporting their ability to provide the best quality of experience for subscribers. F5 security solutions help CoSP to optimize, secure, and monetize their networks. F5 enables CoSP to evolve their network architecture to NFV, with a full portfolio of VNFs, including vADC, vFW, vDNS, and vDRA. Along with costs savings, NFV also offers the ability for CoSP to develop a more agile and flexible network that enables them to innovate and introduce new services to market faster and deliver more tailored services and applications that more closely align to their subscribers' requirements.

Working with HPE, F5 tested their Local Traffic Manager (LTM) VNF with the HPE OpenNFV environment and HPE validated the function. By validating F5 BIG-IP* LTM functions effectively as a VNF in the OpenNFV environment, F5 has demonstrated CoSP opportunity to increase their operational efficiency and ensure peak network performance by providing a flexible, high-performance VNF delivery system, with a foundation for security.

Hewlett Packard Enterprise

With its unparalleled experience in IT and a long standing telecommunications expertise, Hewlett Packard Enterprise is a trusted partner to Communications Service Providers as they embark on a journey to the Telco Cloud. Recognizing that NFV's benefits cannot become fully realized without open solutions and a robust ecosystem for partners, HPE launched its OpenNFV Partner Program for network equipment providers, independent software vendors, and system integrators. The OpenNFV Partner program plays a very important part of the move to create a rich, vibrant, and open ecosystem of VNFs. The goal for HPE's OpenNFV program is to create a platform on which CSPs have the freedom to choose applications from their choice vendor.

In part with the OpenNFV platform, HPE provides the NFV infrastructure (NFVI) running on HPE's converged servers; the HPE Helion OpenStack Carrier Grade which provides the virtualization layer and VIM functionality and the HPE NFV Director for NFVO (NFV Orchestrator) and in many cases VNFM functionality. This platform then acts as a foundational reference architecture to test and benchmark VNFs (from HPE or from any third party partners) for performance.

OpenNFV Labs (located in the U.S., France, Israel, and South Korea) help partners accelerate their design, proof-of-concept, trial, and deployment of cloud-enabled network services. The primary goal for HPE NFV Labs involves assuring CSPs that solutions proposed to them from multiple vendors take a pre-test and integrate – thereby saving them valuable time and effort in network validation during deployment.

Hewlett Packard Enterprise is committed to developing open solutions and an open ecosystem that will accelerate the CSP transformation journey to the Telco Cloud. HPE is a key contributor to open source initiatives like OpenStack, OpenDaylight Project, OPNFV and numerous other Industry initiatives and organizations.

Conclusion: Waiting to Virtualize is too Expensive

A report from ACG Research on the total cost of ownership for a network operator concludes that the traditional approach to adding hardware to expand the network in today's highly competitive environment is "...an unsustainable long-term strategy." They also report that service providers moving to a virtual platform realized savings in just one year and investment payback in three. Plus, they found that bringing innovative services online was reduced from an average of 15 months to 6 months or less. Through collaboration with Intel and HPE OpenNFV labs with a complete HPE NFVI and MANO solution, F5 can deliver real VNF solutions today for CoSP's that are making the transition to a virtualized network.

For more information, visit **https://networkbuilders.intel.com, hpe.com/csp/nfv** and **http://f5.com/nfv**.

Footnote:
[1] Total Cost of Ownership Study Virtualizing the Mobile Core, ACG Research, Gilbert, AZ, July 2015

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