



White Paper

Take Charge of the Cloud Platform for NFV to Maximize Success

Prepared by

Caroline Chappell
Principal Analyst, Cloud & NFV, Heavy Reading
www.heavyreading.com

on behalf of

vmware[®]

www.vmware.com

February 2015

1. Executive Summary

Network operators must master the cloud if they are to realize the competitive benefits that network functions virtualization (NFV) can confer. These benefits include the ability to bring new features and services to market faster than rivals and the streamlining of operational costs so that operators can both boost profit margins and remain price-competitive.

The cloud is a highly automated and efficient platform for running software-based workloads, such as virtualized network functions (VNFs). Cloud application programming interfaces (APIs) enable the programmatic creation of execution environments that match the requirements of individual workloads, while cloud platform intelligence ensures that these environments are multiplexed efficiently across hardware resources, scale on demand and meet performance service-level agreements (SLAs).

Because the cloud is more than a collection of virtualized servers, it requires a new operational approach. Network operators that step up and acquire the knowledge, skills and processes needed to run the cloud platform for NFV will control their own destinies. In other words, they will take charge of the direction of their network business in the 21st century. The cloud is becoming central to the success of thousands of enterprises across the globe. Network operators can draw on the considerable body of experience and best practices that have been built up by these enterprises and their cloud platform suppliers.

This white paper outlines the benefits of a "cloud first" approach to NFV, in which operators take VNFs straight to the cloud. It argues that a horizontal cloud, capable of running as many VNFs from different vendors as possible, delivers the greatest transformation. Since industry dynamics may at first drive operators to acquire multiple cloud platforms to support NFV, this paper advises on ways in which operators can prepare for platform convergence in the future. Finally, it describes the steps that operators need to take to step up and own the cloud for themselves, rather than ceding control over this vital asset to external suppliers.

Section 2 explains why the cloud is so important to NFV, especially a horizontal cloud capable of running as many different VNFs as possible.

Section 3 discusses the four steps required to take charge of the cloud, enabling operators that are implementing NFV to maintain control over the direction of their network business.

2. The Business Case for the NFV Cloud Platform

NFV Is Part of the API Economy Trend

The cloud is not merely a collection of virtualized servers; it is a software-based abstraction of infrastructure resources used to execute digital services, including compute, storage and latterly – through software-defined networking (SDN) – connectivity resources. Due to its abstract (virtualized) nature, the cloud enables virtual resources and the workloads executing on them to be manipulated dynamically, and in an automated fashion, through APIs. This programmatic orchestration of cloud components ensures that each workload at all times has an appropriately scaled execution environment available to it.

The cloud and its APIs are used to great effect by the Internet companies. Amazon, Facebook, Google, Netflix, Twitter, *et al.*, are arguably among the best-known and most successful businesses currently operating on the planet. That they have been able to establish themselves so quickly as household names is down to their pioneering use of APIs to power their businesses. The humble API is no longer simply a technical means of accessing a package of software-based functionality (software component). In the hands of the Internet companies, it has become a strategic weapon in the competitive war to sell goods and services. The API has even given rise to a new term to describe a way of doing business that leverages social networks, mobility and the Internet: the "API economy."

The idea behind the API economy is that business assets have value when they are **virtualized** and exposed through APIs for consumption. Heavy Reading defines virtualization in the broadest sense here to mean the software definition of business assets of whatever kind, making them accessible for mashup – or "orchestration," to use another term – through APIs.

In an API economy, businesses can charge for asset consumption, consume third-party business assets themselves to reduce the cost (and time) of building and owning them, and/or liberate internal assets from siloed use so that they are more widely available to service creators and users across the company.

The benefits of virtualization are extraordinary agility and cost savings, as the Internet companies daily demonstrate. As a result, every company in every industry sector is feeling its effects. Network operators are not immune to these trends. Leading telcos recognize that the API economy is the "new normal" way of doing business. They want to virtualize their business assets – network capabilities, such as the Evolved Packet Core (EPC), and services, such as firewalls – so that they can integrate them quickly, cost-effectively and programmatically into API economy value chains. Participation in the API economy is the ultimate business driver for NFV.

The Benefits of a "Cloud First" Strategy

Network operators came together to define NFV because they want to benefit from the increased speed of service delivery, lower cost of infrastructure ownership and reduced vendor dependence enjoyed by Internet players. This means taking their network-based assets and cutting the ties between software-based functionality and the vendor-proprietary, dedicated hardware this software has traditionally run on.

But simply executing network functions on top of hypervisor-enabled, commercial off-the-shelf (COTS) x86 servers will not deliver benefits at the scale that operators

are hoping for. Server consolidation is at least a 15-year-old virtualization approach, and the world has moved on. Network operators that are serious about achieving significant gains from NFV are taking VNFs straight to the cloud.

Cloud platforms from leading vendors provide intelligent, highly automated execution environments for VNFs, with management properties that extend well beyond server virtualization. Commercially available cloud platform management systems address many aspects of NFV management and orchestration out of the box.

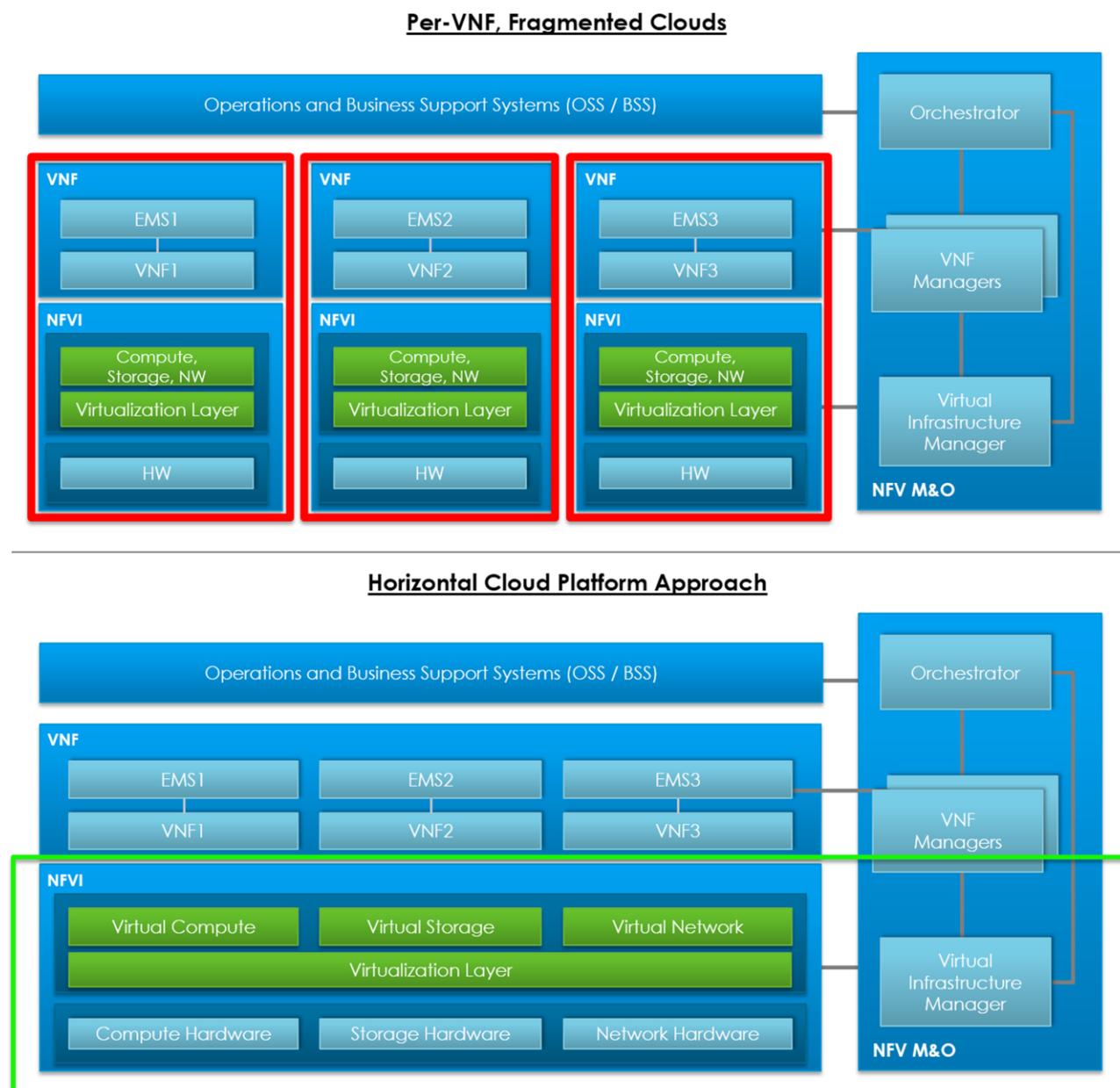
A "cloud first" strategy for implementing the NFV infrastructure delivers far greater benefits than virtualized servers on their own. For example:

- **Faster time-to-market for the launch and scaling of new services.** From a VNF perspective, cloud resources are always available to them whenever they are needed, so multiple types and instances of VNF(s) can be spun up in the cloud at any time, without a long planning and procurement process.
- **Lower capex via intelligent multiplexing of workloads across an elastic pool of resources.** The elastic nature of the cloud means it can highly efficiently multiplex VNFs with different resource usage profiles across a smaller hardware footprint than would be needed if each VNF ran in its own (virtualized) server. Leading cloud platforms intelligently match VNF resource needs with available resources using predictive analytics to avoid resource conflicts.
- **Lower opex as a result of the automatic application of business policies to the placement ("scheduling") of VNFs in the cloud.** The assignment of VNFs to cloud resources can be driven by business policies that ensure each VNF is automatically given the appropriate execution environment according to requirements, such as geolocation, cost, security, performance and anti-affinity/availability.
- **Lower opex through the automation of VNF and infrastructure management functions.** In addition to the automated scheduling of VNFs, a cloud orchestration system carries out many more workload and infrastructure component management tasks automatically throughout their lifecycle, including their configuration, monitoring, maintenance, upgrade, failover and scaling management.
- **Lower opex due to infrastructure-level redundancy.** The abstraction properties of the cloud prevent workloads running on it from being affected by the failure of individual physical server blades, storage devices or connections. The intelligent cloud platform automatically migrates VNFs and/or spins up new instances of VNFs in case of an individual resource failure or for maintenance and support purposes. This avoids the need for expensive truck rolls to fix hardware problems before the network function can be restarted.
- **Reduced business risk through a combination of cloud factors,** including business policy-driven control over VNF execution, high levels of automation that reduce potentially error-prone manual interventions and rapid recovery from hardware failure, avoiding reputational risk from downtime.
- **Lower capex via infrastructure reuse.** If a VNF needs to be moved or removed, the cloud can easily and dynamically reconfigure the infrastructure previously consumed by the VNF to support another, completely different VNF. Since infrastructure resources are not dedicated to a single purpose and can be reused, operators don't necessarily have to buy more hardware every time they introduce a new VNF.

The Horizontal Cloud as End Goal

The transformational benefits of NFV are realized when operators implement a horizontal cloud platform that is capable of running as many of their VNFs as possible – shown at bottom in **Figure 1**. This means specifying a cloud that is vendor-agnostic when it comes to deploying VNFs, since operators are unlikely to buy all their VNFs from the same vendor.

Figure 1: Per-VNF vs. Horizontal Cloud Approach



Source: VMware

Where VNF vendors have virtualized their network function(s) so that they only run on the vendor's cloud platform, operators may end up with a fragmented set of cloud platforms each supporting a per-VNF-vendor approach. In this scenario, operators may experience some capex savings versus running the VNF(s) on the same vendor's dedicated hardware and some opex savings through the automated management of the VNF and its cloud environment. If the operator locates multiple instances of the vendor's cloud across its infrastructure, it may be relatively quick and easy to launch new instances of the vendor's VNF and any future VNFs from that vendor in those different locations.

However, the cost benefits and agility that is achievable with a horizontal cloud incrementally diminish with a fragmented approach. The benefits of using an individual cloud platform versus proprietary hardware will be outweighed by the overheads associated with running multiple cloud platforms from different VNF vendors. Each cloud platform effectively becomes a silo based on a specific set of technologies that requires its own operational processes and team. As a result, VNFs from one vendor, dependent on that vendor's cloud platform, will not be portable to another vendor's cloud.

In this scenario, management complexity and opex will actually increase, because operators will need to sustain multiple operational teams and they will face VNF/cloud platform integration challenges when network services span VNFs executing on different platforms. Cloud benefits, such as higher utilization of infrastructure due to resource sharing, will be lost.

Of course, a horizontal cloud platform is the ideal and not always possible given market realities. Industry dynamics, such as vendor relationships, the project-based nature of service deployments and budgets, organizational structures and cultures that naturally tend toward silos, and the desire to have a "single throat to choke" where network function SLAs are concerned may all have the unintended effect of introducing multiple cloud platforms into the organization.

Operators need to take steps to mitigate the effects of cloud platform fragmentation, especially if they know that they will want to converge onto a horizontal cloud at some point in the future. They can prepare for this by ensuring that VNFs are as far as possible free from dependencies on ("hooks" into) specific cloud platforms and that VNFs and each cloud platform can be orchestrated through a common, standardized set of APIs. They will need to mandate globally consistent management processes – both automated and manual – across different cloud platforms and enforce global network addressing schemes. This will make it easier to migrate VNFs onto a horizontal cloud platform in future.

Heavy Reading research shows that leading operators prefer to work with vendors that support a horizontal cloud approach. Such operators understand that a "cloud first" strategy requires establishing one cloud platform capable of supporting their entire landscape of network functionality, today and in the future.

3. Taking Charge of the NFV Cloud Platform

Given the significance of the API economy, no business today can afford to ignore its key enablement platform: the cloud. If network operators are serious about implementing NFV-enabled networks that transform their service agility, cost structures and business risk, and allow them to compete with the leading API economy players, they need to acquire the right cloud platform and, critically, the right cloud operational expertise.

This requires operators to take four big steps:

- **Understand the cloud and how it is different from merely running network functions on virtualized servers.** Become familiar with the benefits of the cloud – shared resources, scalability, flexibility, automated operations – and the stack of cloud technologies that create these capabilities. Network operators that have IT departments already working with cloud and/or enterprise-facing business units delivering cloud-based services to corporate customers will have an advantage here: They can draw on internal knowledge and skills to help them understand the cloud. Network operators not yet in this fortunate position will need to consult vendors with key cloud technologies and the experience of operating enterprise clouds. The enterprise market has the most advanced knowledge of cloud today.
- **Step up and take ownership of the cloud platform.** The cloud is critical to the economics of a network operator's future business and the means through which an operator will competitively differentiate itself in API economy value chains. If operators adopt a laissez-faire attitude to the cloud, allowing VNF vendors to dictate the cloud technologies and platforms operators must install, they will lose the ability to lead their markets. They will depend on VNF vendors' timescales and roadmaps, rather than being able to innovate ahead of the market, and they will compromise on key cloud efficiencies, especially around resource sharing and VNF placement.
- **Separate cloud platform development from VNF acquisition.** A major goal of NFV is the separation and abstraction of software-based network function away from underlying hardware. Operators need to ensure they have different workstreams addressing what's best for the cloud platform – that it is scalable and generic enough to multiplex large numbers and different types of VNFs – and what's best for the network from an application (VNF) perspective. This will allow operators to build the right platform first and then onboard whatever VNFs they need.
- **Establish cloud operations.** Cloud-based NFV enables a single platform team to support many different kinds of VNFs, breaking down the management silos that proliferate in the traditional network. This will require organizational change and new operational processes. As part of this change, operators need to adopt the automation mindset associated with the cloud so that they can rapidly onboard, configure and policy manage VNFs cost-effectively and with very low risk. Here, operators can adapt powerful cloud automation approaches and techniques, such as DevOps, being pioneered in the enterprise market.

4. Conclusion

In conclusion, while the enterprise market has steadily worked its way to the cloud via server virtualization and consolidation over the past decade, NFV enables operators to go straight to the cloud. The cloud gives operators rapid access to API economy benefits, such as faster time to market for new services and significantly lower operational costs, and allows them to insert network assets faster and more cost-effectively into API economy value chains.

Operators will realize the greatest transformational effects from the cloud when they implement a horizontal platform capable of running the majority of their VNFs. However, this is the long-term ideal and may not be practical when operators are starting out with NFV. For various reasons, operators may find they need to implement multiple cloud platforms, sometimes on a per-VNF basis. Nevertheless, operators should try and specify as much interoperability between VNFs and cloud platforms from different vendors as possible, so that they can converge onto a single horizontal cloud over time, should they wish.

Understanding and operating the cloud is rapidly becoming a key requirement for any company expecting to be commercially successful in the 21st century. Operators need to be proactive in acquiring cloud knowledge and technology if they want to control their own destinies.

NFV is a large project and operators will need help from the market in implementing it, but they should take care not to attach themselves too closely to the fortunes of a particular NFV/VNF vendor. Since the enterprise market has the most advanced knowledge of cloud today, operators can learn from companies that have leading-edge enterprise cloud technologies. Armed with the right information, skills and technologies, operators can then take charge themselves of how the cloud is applied to their networks.

About VMware

VMware is a leader in cloud infrastructure and business mobility. Built on VMware's industry-leading virtualization technology, our solutions deliver a brave new model of IT that is fluid, instant and more secure. Customers can innovate faster by rapidly developing, automatically delivering and more safely consuming any application. With 2014 revenues of \$6 billion, VMware has more than 500,000 customers and 75,000 partners. The company is headquartered in Silicon Valley with offices throughout the world and can be found online at www.vmware.com.