Transitioning to network function virtualization with Citrix NetScaler

Virtualization has been one of the most powerful forces in enterprise IT infrastructure over the past decade, and now Telcos are looking to reap tremendous benefits by tapping into the potential of NFV to achieve increased utilization of compute resources and greater agility in managing and deploying them.

In the past few years, enterprises have benefited greatly from running legacy or newly built applications on a virtualized infrastructure using standard operating systems (Windows or Linux) as virtual machines on hypervisor platforms. Cloud service providers have taken a similar approach to virtualizing the underlying infrastructure. However, since most service providers have to offer this infrastructure "as-a-service" (IaaS), they have virtualized both the compute resources (by offering virtual machines) and parts of the network, since this generally must be provisioned, scaled and managed just like any other element of the solution.

The core networks of telco operators are the next frontier for companies seeking to reap the benefits of virtualization. However, the scale and complexity of telco infrastructure and networks are vastly different compared to large enterprises or service providers. In addition, the initial wave of cost and agility benefits comes from virtualizing core infrastructure, while the ability to run applications on these virtualized platforms is a longer-term benefit.

One of the main challenges facing telco operators today is how to scale new networking services to keep pace with the rapid increase in mobile devices. Adding new networking hardware is expensive, and managing it is becoming more complex due to a lack of compatibility among different vendors' proprietary hardware. As a result, launching new network services is difficult and time-consuming.

To accelerate the delivery of new network services while reducing CapEx and OpEx, telco operators are turning to a new type of network architecture called Network Functions Virtualization (NFV). The aim is to decrease time to value and increase scalability and agility while promoting innovation.

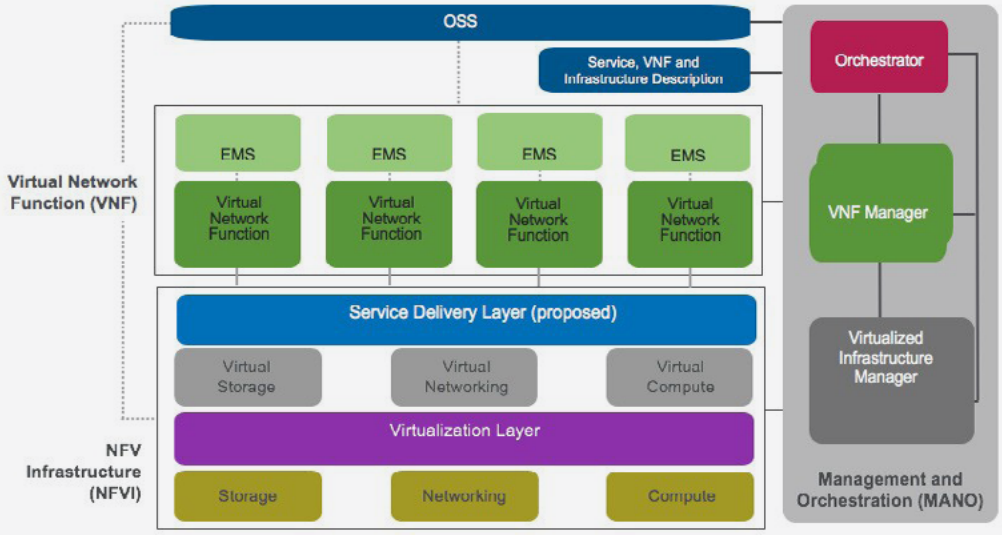
This solution overview provides an introduction to NFV and describes how Citrix technology can help telco operators successfully implement NFV in their networks.

Introduction to NFV

The ability to run infrastructure elements as virtual machines or software appliances has been around for a long time. Now, NFV gives providers the ability to take network services and traffic management functions as software components and run them in a virtualized environment.

Most discussions about NFV encompass not only virtualized network appliances (also called virtualized network functions or VNFs), but also special additional software required to replicate the functionality of these network elements in a large, scaled telco environments, such as service chaining, orchestration and interfacing with new or legacy billing systems. Therefore, NFV is much broader than the virtualization platform and virtualized network elements; it also includes an orchestration function typically called a MANO (for management and orchestration), which in turn comprises a few distinct elements.

Figure 1. The ETSI NFV MANO framework with the three functional blocks



The European Telecommunications Standards Institute (ETSI, introduced later) defines NFV in this way:

Network Functions Virtualization aims to transform the way that network operators architect networks by evolving standard IT virtualization technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage, which could be located in datacenters, network nodes and in the end user premises. It involves the implementation of network functions in software that can run on a range of industry standard server hardware, and that can be moved to, or instantiated in, various locations in the network as required, without the need for installation of new equipment.[1]

As shown in Figure 1, a typical NFV stack is composed of three elements:

1. NFV infrastructure (NFVI): This is the core compute, networking and storage infrastructure on which the networking functions run. Beyond the raw elements of hardware needed to run these workloads, the infrastructure will also typically have a virtualization layer with a hypervisor.
2. VNFs: These are the actual virtualized workloads that run on top of the NFV infrastructure. These are the workloads previously handled by physical hardware appliances but are now running as virtual machines/appliances.
3. MANO: This layer handles the lifecycle of the VNFs running on the NFV infrastructure. The MANO is the "brains" of the operation and provides the broader management of resources and workloads.

The MANO itself is broadly composed of three components:

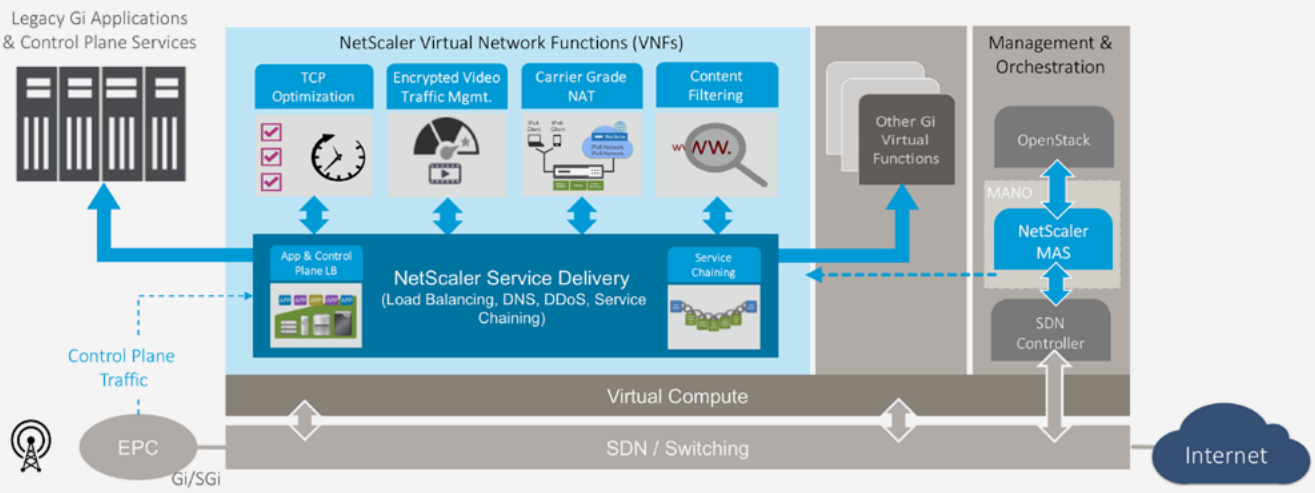
1. NFV Orchestrator: As the name implies, this software is responsible for organizing and managing all core functions across the MANO layer and coordinating them with the workloads running on the system.
2. VNF Manager: This component manages the lifecycle (provisioning, teardown, scaling) of VNFs running on the system.
3. Virtualized Infrastructure Manager (VIM): Most people would recognize this as the virtualization management layer, and there has been a tremendous focus on this layer with open source platforms like OpenStack, CloudStack and a number of other solutions. The VIM controls the three core components on which the NFVI runs—compute, storage and core networking.

In essence, a NFV infrastructure setup is not unlike a large, virtualized infrastructure with workloads that are primarily VNFs and an orchestration system to manage all of them.

One of the unique aspects of the NFV architecture, as defined by core standards bodies such as OpenNFV, is complete openness. You can build an entire NFV stack out of best-of-breed components, instead of being locked into a single vendor solution with potentially lower-performing or lower-functioning components. The ability to pick and choose different components also future-proofs your infrastructure against obsolescence—you can upgrade components independently from each other and gain performance and feature benefits over time.

[1] Network Functions Virtualisation. ETSI white paper. http://portal.etsi.org/NFV/NFV_White_Paper.pdf

Figure 2. NetScaler products in the NFV architecture



Citrix technologies for NFV

Citrix is helping telco operators realize the benefits of NFV with powerful network functions implemented in software. NFV will transform network and telco datacenters, making them closely resemble architectures found in public clouds where Citrix solutions are heavily deployed. This allows both telco operators and prospective networking partners to benefit from faster time to market by leveraging Citrix technologies in their NFV plans.

Citrix offers a broad portfolio of NetScaler products that can help you build your NFV stack—all driven by open APIs and interoperability standards.

As shown in Figure 2, NetScaler mobile network services fit into the full NFV MANO (Management and Orchestration) stack of a fully virtualized carrier network.

Powerful NetScaler services such as encrypted video and TCP optimization, CGNAT and content filtering are all available to be deployed as Virtual Network Functions (VNFs) in the NFV stack.

You can also see the role played by NetScaler services in service delivery in NFV, delivering reliable and secure control-plane load-balancing , traffic-steering and service-chaining. In a virtualized network, all virtual network functions will require traffic distribution using load balancing at Layer 4 through Layer 7.

NetScaler Management and Analytics System (NetScaler MAS) plays the role of the NFV Manager. This software product provides automation and orchestration, as well as data-collection from the network and advanced analytics at scale . NetScaler MAS provides the APIs to facilitate interoperability to MANO orchestration as well as providing APIs to provide access to the rich data coming from the network.

The richness of the data from the network is very important for use-cases from trouble-shooting to capacity management and even to feed into the orchestration system.

It is important to note that NetScaler can support a deployment scenario where (small) sites have a number of network services deployed on an appliance and large sites are completely virtual. VNF workloads, and associated licensing can be managed dynamically by NetScaler MAS between any deployment scenario, any cloud.

Migration Scenarios

The fully orchestrated and automated network is the end goal for NFV but the migration of the network from the current state to this ideal scenario will involve careful planning and migration. Citrix supports any migration scenario because both the VNF software and management interfaces and MAS orchestration are the same, whether the services are deployed on an appliance or as VNFs. In addition the flexible licensing model ensures that investment is protected and independent of the choice of initial deployment.

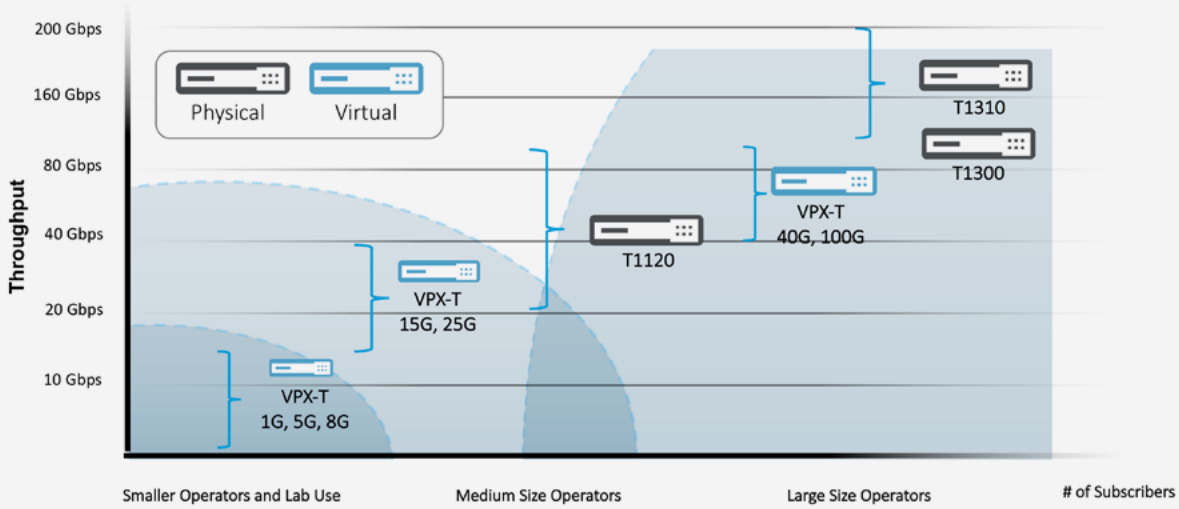
Best optimization technology and roadmap

NetScaler is the best choice for building your NFV stack to operate your workloads because it offers deep TCP optimization in fixed and mobile networks, and has been tested in 3G, 4G and 4G-Advanced networks and with protocols such as Citrix NILE, which was developed for wireless networks. In addition encrypted video traffic can be identified and managed

Proven in the largest deployments

NetScaler powers some of the largest cloud infrastructure service providers in the world today. A key set of factors have made NetScaler the preferred provider of traffic management for these dynamic and flexible deployments—virtualized form factor, centralized management with distributed deployment model, multi-tenancy and isolation in a virtualized environment and, of course, scale. Given that the NFV stack looks very similar to a cloud service provider environment, it pays to go with a product that is already proven to operate and scale in such a virtualized environment.

Figure 3.



Scalability and Carrier-Grade performance

NetScaler software can be deployed on carrier-grade appliances or on Commercial off-the shelf (COTS) hardware. Over 100Gbs of throughput can be achieved on a single NetScaler VNF. Several terabits of performance can be achieved through clustering.

Intelligent, multi-protocol traffic management

NetScaler supports the most important protocols that need to be managed and load balanced, including Diameter, DNS caching and load balancing, SMPP and SIP as well as providing the ability to perform subscriber-aware traffic steering.

NetScaler offers load balancing of these protocols as a service, as well as TCP optimization , encrypted video identification and optimization, CGNAT for the mobile core. For the datacenter, NetScaler can provide full ADC functionality, as well as AppFirewall and SSL offload for applications.

Open standards

Citrix is a member of many important open source initiatives related to NFV and software-defined networking (SDN), as listed below. Adherence to industry standards gives customers greater flexibility in choosing the solutions that meet their needs without being locked into a vertically integrated stack with potentially subpar elements.

ETSI

In November 2012, seven of the world's leading telecom network operators selected ETSI to be the home of the Industry Specification Group for NFV. The membership of ISG NFV has grown to more than 270 companies, including 38 of the world's major service providers as well as representatives from both telecoms and IT vendors.

OPNFV

OPNFV is an open source project focused on delivering an open platform and reference architec- ture for building and deploying NFV platforms. One of the core principles of OPNFV is true openness of products and technologies used in the platform to avoid vendor lock-in at any layer of the stack.

OpenDaylight

OpenDaylight is an open platform for network programmability to enable SDN and create a solid foundation for NFV for networks of any size and scale. OpenDaylight software is a combination of components including a fully pluggable controller, interfaces, protocol plug-ins and applications.

Conclusion

Telco operators can choose from a growing number of NFV products and solutions. Citrix technologies are currently used by many of the largest operators and can provide the capabilities you need to realize the benefits of NFV quickly and easily. NetScaler, is fully integrated with a number of other leading NFV components and is proven to operate at scale. The software-first architecture of NetScaler ensures that you can seamlessly transform and grow your network and continue to innovate in the future.

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