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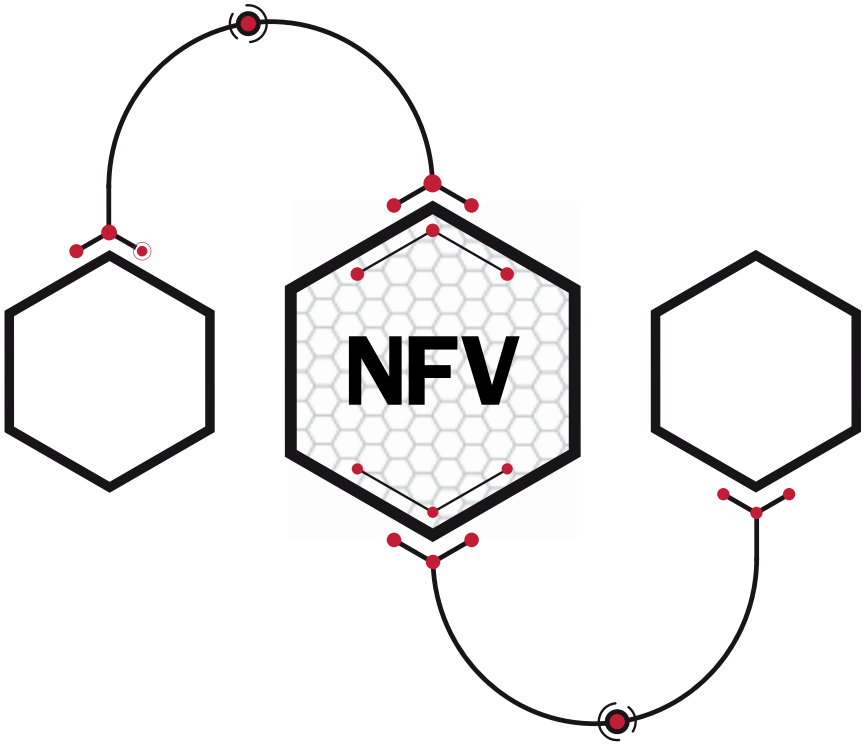
Network Functions Virtualization

Role of ADCs in Network Functions Virtualization (NFV) - Whitepaper



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Industry Challenges Leading to NFV

Over the last few years the Telecom industry experienced an increasing demand for additional bandwidth and advanced services. The current approach of adding additional hardware is not scalable nor cost efficient. Network based services that operators are rolling out consist of lengthy purchasing cycles, deployment and configuration of several physical network components from various vendors and result in a longer time to market with limited network agility.

Network carriers are looking to reduce their CAPEX and OPEX as well as accelerate the deployment of new network/web services. As a result, the European Telecommunications Standards Institute (ETSI) created the Network Function Virtualization Industry Specification Group (NFV ISG).

Network Functions Virtualization (NFV) transforms the way network operators design its networks by evolving standard IT virtualization technology to support network-centric workloads. NFV decouples the network functionality from its proprietary hardware and replaces it with software that provides the same network functionality and benefits. It runs on a range of industry standard commercially off the shelf (COTS) x86 server hardware that can be moved, or instantiated in various locations within the network, without installing new equipment.

Business Benefits of Migrating to NFV

NFV ISG brings the value proposition that cloud computing brought to enterprise computing with several key benefits.

- TCO reduction via decoupling software from hardware: Removing the link between network functionality and specific hardware enables independent innovation processes in both areas. The use of the same standard hardware for various network functions enables the reuse of infrastructure and eliminates “vendor lock”. It reduces the devices’ RMA stock and related cost and enables efficient resource utilization.

- Greater network agility: With network functions virtualized, operators can maintain a pool of standard hardware resources that can be shared among several network functions on demand. With a pool of resources in place, the provisioning of network functions is automated and facilitates a faster introduction of new network services throughout its life-cycle stages (development, staging, production and recovery).

- Dynamic and scalable operation: NFV helps alleviate scalability challenges as additional capacity can be added to a network function by provisioning additional instances and distributing the work among the functionally-equivalent instances. Capacity can be automatically tailored to actual traffic.

NFV Use Cases

While every network function can be virtualized, there are some functions that are more natural candidates than others. For example, in mobile networks the Evolved Packet Core (EPC) architecture has potential candidates for virtualization that can be the Mobility Management Entity (MME), and the Serving and Packet Data Networks Gateway (S/P-GW) Network Functions (NFs). Similarly, several of the Network Functions (NFs) in the IP Multimedia Subsystem (IMS) can be virtualized as well as Session Border Controllers (SBC). Since IMS is usually deployed alongside EPC, the virtualized NFs can be consolidated on the same hardware - leading to TCO savings.

Another example is Content Delivery Networks (CDN). CDN service providers commonly deploy content caches near the edge of a network to improve quality of experience. Today, these caches are dedicated physical appliances per CDN provider. To ensure QoE, these appliances are designed for peak usage (usually evenings and weekends), leading to a wasteful infrastructure. There is a lot of optimization potential in virtualizing the content caches and deploying them on shared hardware.

Role of ADCs in NFV

In an NFV infrastructure, Application Delivery Controllers (ADC) play several crucial roles. First, the promise of elastic services and on-demand horizontal scaling (i.e., scale-out and scale-in) requires load balancing capabilities. Load balancing and related functionality such as health checking needs to be provided to Virtual Network Functions (VNFs) by the NFV infrastructure in order to keep the benefits valid. Alternatively, VNFs may include a load balancing component within the VNF. In both cases, virtualized ADCs designed to work in an NFV compliant environment are required to fulfill the load balancing role.

Secondly, ADCs can act as the traffic classification and enforcement engine for the VNF Forwarding Graphs (VNF FGs). A Network Service (NS) is defined in the NFV architectural framework as a logical graph of network functions that traffic should traverse within a specific order. The network functions in these forwarding graphs may be virtual or physical, and reside anywhere in the network including remote locations. Additionally, forwarding graphs are dynamic (network functions in the graph may be added or removed) and many coexist in the same infrastructure (traffic can be classified and forwarded through different graphs).

Alteon VA for NFV

As an active contributor in both NFV and Software Define Network (SDN) working groups, Radware developed a holistic strategy to enable carrier networks to become smarter, more programmable, flexible and cost-effective through SDN transformation and NFV compliance.

An important building block in that strategy is the Alteon VA for NFV environments - the industry's first NFV-compliant, software-based ADC on the market. It helps reduce the total cost of ownership for carrier's load balancing and traffic steering functions by decoupling ADC functions from dedicated underlying hardware, offering the same benefits through a highly-scalable, software-based solution. Alteon VA for NFV can run on commercially off the shelf (COTS) server infrastructure and delivers up to 160 Gbps of throughput capacity. Furthermore, by leveraging Radware's "ElasticScale" SDN application, carriers can dynamically support multi Terra-bit/sec scale-out through clustering of multiple Alteon VA for NFV instances.

As part of the NFV ecosystem, Alteon VA for NFV is OpenStack ready. It features complete integration with NFV-based infrastructure virtualization and orchestration frameworks such as OpenStack. By leveraging Radware's vDirect plug-in and its RESTful API, Alteon VA for NFV realizes data center workflow automation and simplification of day-to-day network operations.

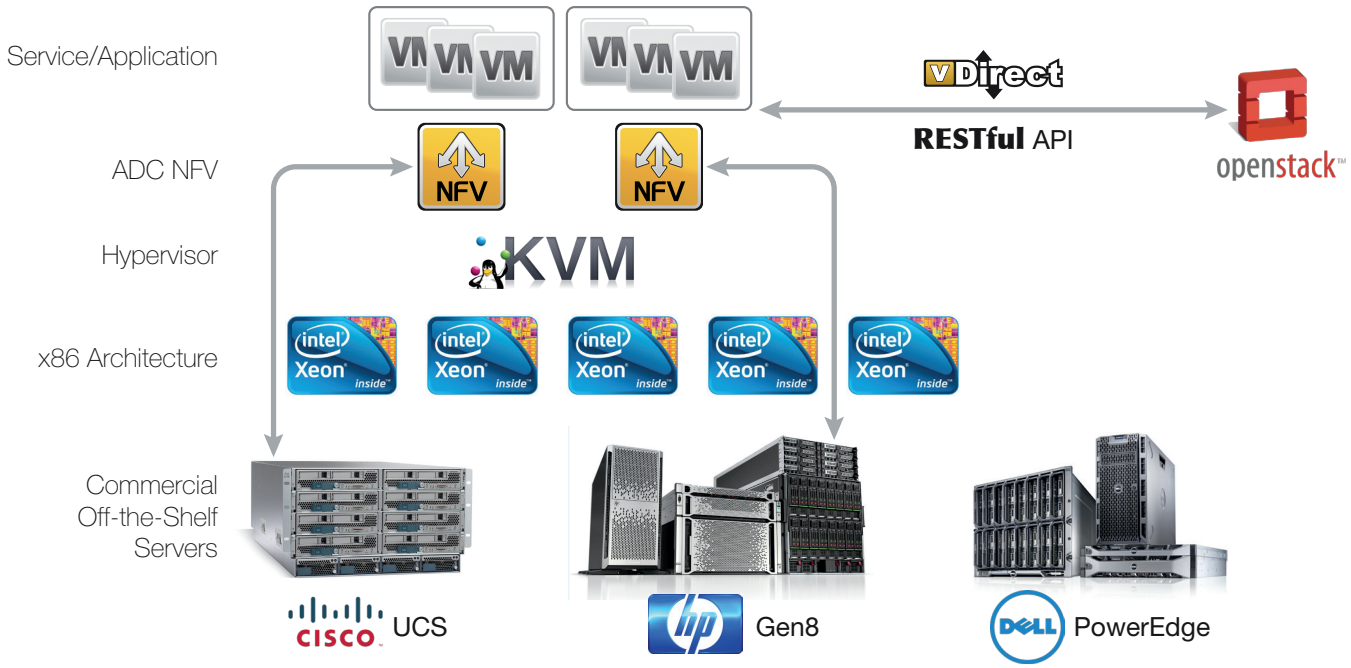
Alteon NFV Architecture: Built to Perform and Scale

Running on x86 COTS compute infrastructure, Alteon VA for NFV leverages several unique technologies that make it scale and perform like a high-end hardware platform. These key unique capabilities include:

- Up to 16-core support with efficient resource utilization. By employing multi vCPUs, Alteon VA for NFV can linearly scale when more processing capacity is needed, utilizing the compute resources that are already available in the server virtualization infrastructure.

- Leveraging DPDK for fast packet processing, Alteon VA for NFV can extensively scale with fast packet processing capacity by leveraging Intel's Data Plane Development Kit (DPDK) library that optimizes traffic processing for x86 processors.

- vSwitch bypass circumvents the vSwitch so Alteon VA for NFV can dramatically reduce processing overhead. This is achieved with NIC pass-through, zero packet copying and the fact that the network interfaces are not shared with other VMs.



Alteon NFV x86-based Architecture

Advanced Carrier-Grade Network Functionality

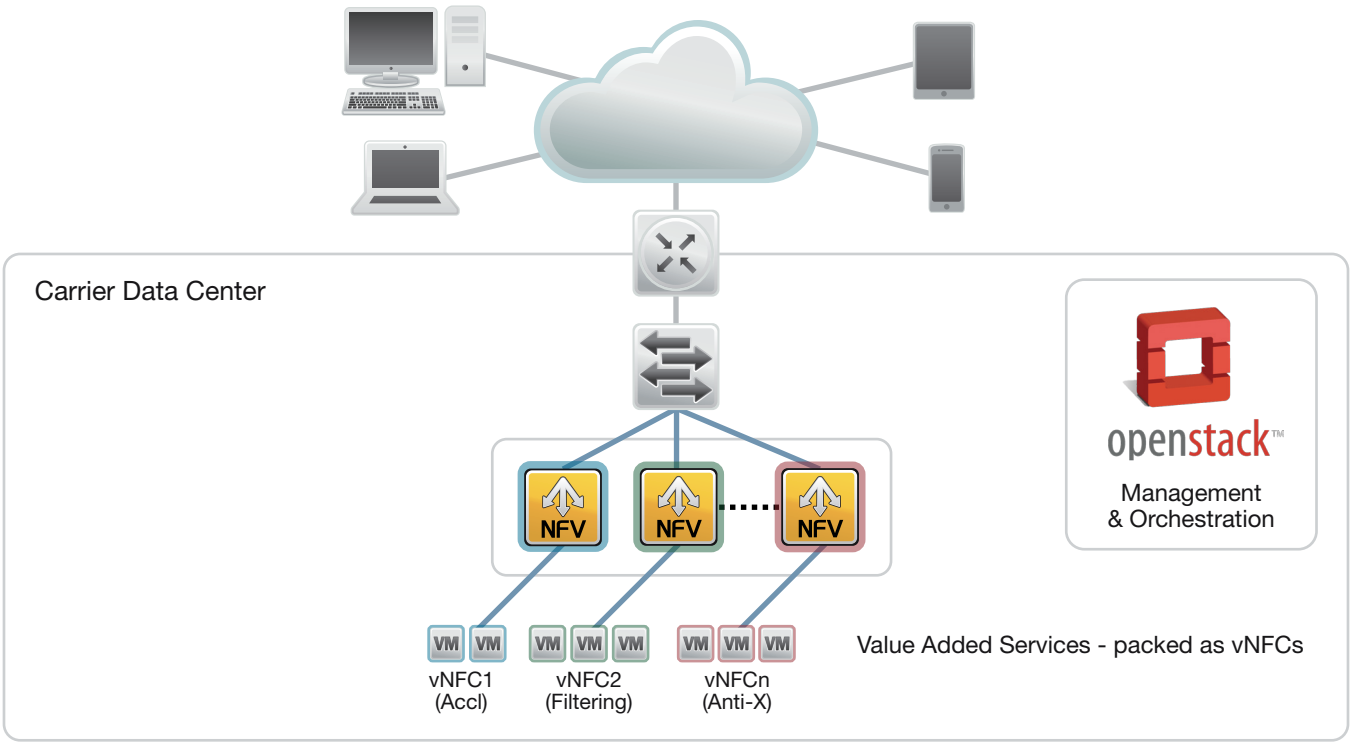
To streamline mobile service delivery, mobile networks support advanced traffic steering and header manipulation with real time policy enforcement that is based on policies stored and/or generated in its control plane.

While ADC solutions are designed to provide such functionality, carriers virtualizing network functions based on the NFV guidelines require the ADC solution to scale to mega capacities per instance while running as virtual instances in an NFV environment. Alteon VA for NFV combines virtualization support for NFV environments with ultra-high capacities and advanced network functionality. It leverages its multi-proxy architecture to deliver a set of application delivery services tailored and adjusted for carrier networks. It enables full control over traffic flows with granular classification down to the user level, real time policy enforcement, Layer 4-7 load balancing, and global server load balancing.

Use Case: Gi-LAN Steering with Alteon NFV

An example of a forwarding graph is traffic steering on the Gi-LAN. Mobile operators frequently offer subscribers value added services (VAS) such as parental control, video optimization, caching, etc. Out of these services each subscriber selects the one he/she wants. As a result, each subscriber may have a different forwarding graph within the Gi-LAN. With millions of subscribers connecting simultaneously, the traffic steering solution needs to scale up (in peak times) and scale down (in slower periods) in terms of total throughput as well as table capacity (to hold the millions of simultaneous graphs).

Through extensive traffic classification, transparent forwarding capabilities, and very large network tables, Alteon VA for NFV is the perfect solution for enforcing user-aware traffic forwarding graphs in real time. In addition, being an elastic VNF ADC, the steering capacity is unlimited.



Alteon NFV Traffic Steering in NFV Environment

Summary

Migrating to NFV delivers significant benefits for carriers:

- **Reduced TCO** of its network by decoupling network functionality from its dedicated hardware and enabling it to run on commercially off the shelf x86 servers.
- **Increased business and operation agility** with various network functions virtualized and running on common COTS x86 servers, resources can be shared and assigned on demand.
- **Dynamic and scalable operation** as NFV enables seamless addition of capacity on demand per network function through simple provisioning of additional instances.

An important element required to deliver the full benefits of NFV is an ultra-high capacity ADC designed for NFV environments. Radware's Alteon VA for NFV not only delivers the most advanced ADC solution functionality required by carriers, but it is also designed and optimized to operate in compliance with the latest NFV specifications, complemented by seamless automation, unmatched performance and scalability.