SOLUTION BRIEF

Accelerate Nuage VSP with Mellanox Offloads: VXLAN, ASAP^2 and OVS DPDK

Executive Summary

Nuage Networks™ and Mellanox Technologies jointly provide an extremely efficient Software Defined Networking (SDN) solution, which combines the agility, elasticity and automation of the Nuage Networks Virtualized Services Platform (VSP) and the performance, efficiency and scalability of Mellanox smart network adapter technology. Furthermore, Nuage and Mellanox joint solution helps customer realize the vision of multi-tenant cloud scale overlay networks by substantially improving the throughput and packet rate performance while freeing precious CPU cycles. Mellanox Smart network adapters regain infrastructure efficiency, boost packet performance and significantly reduced CPU overhead so you can deploy your cloud infrastructure with confidence.

SDN with Nuage Virtualized Services Platform (VSP)

SDN is a revolutionary approach to designing, building and operating networks; it delivers business agility while lowering capital and operational costs through network abstraction, virtualization and orchestration.

Nuage Networks VSP is a leading overlay SDN platform that realizes secure network virtualization without requiring a networking hardware upgrade. Virtual Routing and Switching (VRS) is the distributed forwarding module within VSP based on Open vSwitch that serves as a virtual endpoint for network services. Through the VRS, changes in the compute environment are immediately detected, triggering instantaneous policy-based responses in network connectivity to ensure application performance.

HIGHLIGHTS

- Agile, elastic and secure SDN deployment with unconstrained, deterministic cloud network performance (10/25/40/50 and 100 Gb/s throughput to the server host)
- Enhanced cloud infrastructure efficiency and higher application workload density resulting from reduced CPU overhead associated with overlay virtual network processing
- Integrated and tested solution ready for Software Defined Data Center (SDDC), Network Functions Virtualization (NFV), and public, private and hybrid cloud deployments
- ASAP^2 delivers VRS uni-directional VXLAN performance as high as 56 MPPS for small packets and near line-rate for large packets

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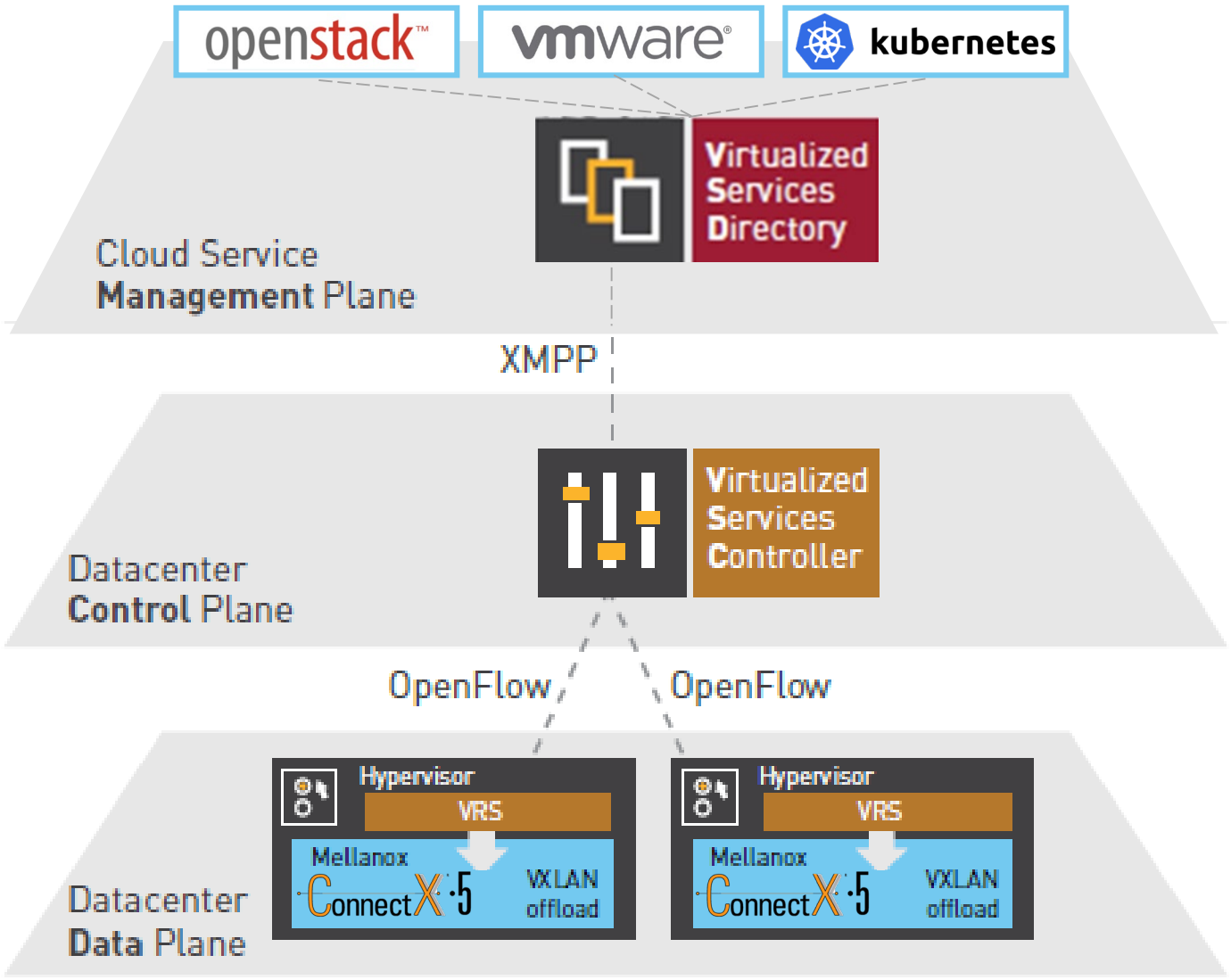
As an overlay SDN solution, Nuage Networks VSP uses tunneling protocols such as VXLAN to encapsulate the original payload. For NICs that don't recognize these new packet header formats, even the most basic offloads stop functioning, which means that all packet-manipulating operations need to be done in software in the CPU. This can cause significant network I/O performance degradation and large CPU overhead, especially as server I/O speed evolves from 10 Gb/s to 25, 40, 50, or even 100 Gb/s. To reduce server I/O, overlay network processing needs to be offloaded to I/O hardware on the network adapter. Starting from the ConnectX®-3 Pro series of NICs, Mellanox supports hardware offloads, which includes stateless offloads such as checksum, RSS, and GRO for VXLAN/NVGRE/GENEVE packets. With VXLAN offload, I/O performance and CPU overhead can be restored to levels that are like those that are VLAN-based. The VXLAN offload feature is further enhanced to encapsulate and decapsulate VXLAN packet headers in the Mellanox ConnectX-5 series of adapters, which supports a full range of speeds including 25, 50 and 100 Gb/s.

Business Benefits

Nuage Networks Virtualized Services Platform (VSP) is an open SDN platform for virtualizing datacenter networks using x86 hardware to reduce cost, lower maintenance and improve design cycles. Mellanox ConnectX-5 intelligent NIC offloads software policy and overlay networking to embedded e-switch in the NIC.



Nuage Virtualized Services Platform Accelerated with Mellanox ConnectX-5 Intelligent Network Adapters

Unconstrained SDN Performance

Based on large IO loading with netperf TCP_STREAM benchmark results between virtual machines hosted on KVM, the Nuage Networks-Mellanox joint solution delivers near wire- speed throughput at 100 Gb/s. The Nuage VRS packet rate is 56 MPPS, approximately 20X better than OVS Kernel without the VXLAN hardware offloads. Related Linux bonded NIC tests with active backup show Mellanox ConnectX-5 intelligent NICs running Nuage Networks VSP are resilient against connection failures with minimal throughput and CPU impact.

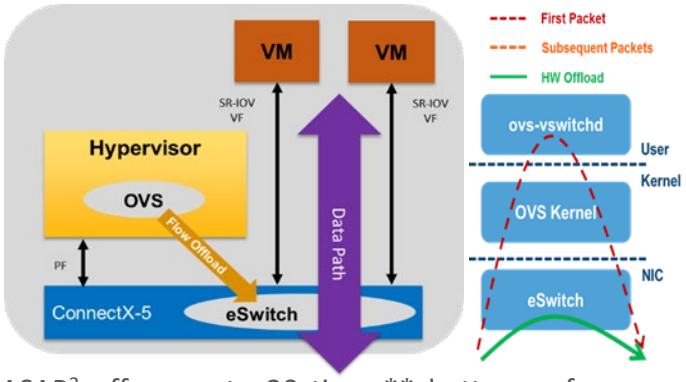
OVS over DPDK

To enhance the CPU's capability to process packets, Data Plane Development Kit (DPDK), a set of data plane libraries and network interface controller drivers were introduced. Aimed to increase packet processing, DPDK changed the packet receive operation from push mode to poll mode, eliminating a number of interrupts, context switches and buffer copies in the Linux network stack. But the downside is also easy to see; IT professionals who deploy DPDK need to dedicate a significant number of CPU cores just for the packet processing. These expensive CPU cores will spin in loops, running at GHz rates and basically doing nothing, all while simply waiting for packets to arrive.

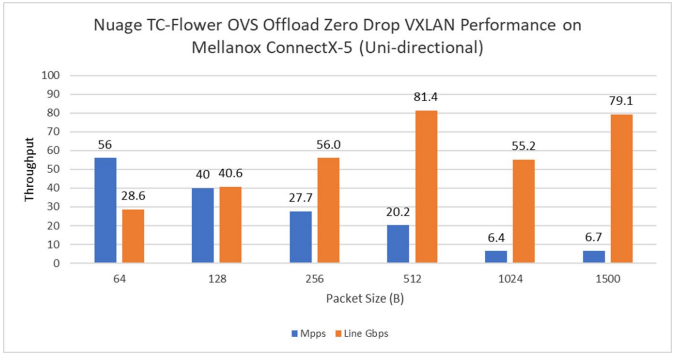
Mellanox ConnectX-5 adapters recorded 148 Mpps of DPDK bi-directional VLAN performance*. Twelve CPU cores were required to achieve this result for a very simple forwarding application ideally distributing load between all of the cores. VXLAN acceleration performance while running OVS over DPDK is typically about 7-8 Mpps using 2 cores. Nuage AVRS which uses DPDK also sees significant performance boost by using Mellanox DPDK driver. For more complex operations such as VXLAN tunneling and multiple header re-writes, the number of cores required to achieve similar throughput increases substantially. Imperfect load balancing further increases the number of CPU cores required to sustain high throughput. Eventually so many cores are required that an entire server may be consumed with routing and switching leaving little or no resource for VNFs when extreme performance is required. Performance tests using ConnectX-5 and OVS-DPDK (Open vSwitch with DPDK) confirm this expectation.

Mellanox ASAP²

To overcome the resultant high CPU utilization, Mellanox created ASAP² - Accelerated Switching and Packet Processing®, an alternative and better way, to solve the NFV packet performance challenge. This solution combines the performance and efficiency of server/storage networking hardware and the adapter along with the flexibility of virtual switching software to deliver software-defined networks resulting in the highest total infrastructure efficiency, deployment flexibility and operational simplicity.



ASAP² offers up to 20 times** better performance than non-offloaded OVS solutions, delivering software- defined networks with the highest total infrastructure efficiency, deployment flexibility and operational simplicity.



OVS Offload Performance with ConnectX-5

Further, these results included zero CPU usage for VXLAN tunnels and no packet loss in forwarding applications based on of Nuage Networks VSP.

*http://fast.dpdk.org/doc/perf/DPDK_19_02_Mellanox_NIC_performance_report.pdf

**https://bit.ly/2VXN9Ew OpenStackVancouver, May 2018

Conclusion - Enhanced Cloud Efficiency

Intelligent ConnectX-5 NICs from Mellanox Technologies enhance the total infrastructure efficiency of Nuage Networks SDN deployments substantially by offloading computationally intensive packet processing operations, freeing costly compute resources to achieve higher application workload density. By offloading virtual overlay network processing from the CPU to the NIC, CPU overhead is significantly reduced. Similarly, NFV packet performance can either be improved through DPDK or ASAP², empowering the infrastructure to support more application workloads, thus improving cloud infrastructure efficiency.

About Mellanox Technologies

Mellanox Technologies (NASDAQ: MLNX) is a leading supplier of end-to-end Ethernet and InfiniBand intelligent interconnect solutions and services for servers, storage, and hyper-converged infrastructure. Mellanox intelligent interconnect solutions increase datacenter efficiency by providing the highest throughput and lowest latency, delivering data faster to applications and unlocking system performance.
More information is available at: www.mellanox.com or @mellanoxtech on Twitter.

About Nuage Networks

Nuage Networks strikes at the heart of the cloud networking challenge: Choreographing datacenter and wide-area networks to maximize responsiveness, utilization and visibility. Nuage Networks delivers a highly programmable infrastructure that bridges the gap between the application-centric view and the equally important network-centric view, realizing the full power of SDN. The Nuage Networks solution combines ground breaking SDN and virtualization techniques with unmatched networking expertise to deliver a massively scalable solution that consistently spans datacenters and remote locations. Our solution enables enterprise IT to respond instantly and securely to the demands of users and applications anywhere.

Discover more at www.nuagenetworks.net and follow @nuagenetworks on Twitter.

Want To Learn More?

Nuage Networks Virtualized Services Platform:

http://www.nuagenetworks.net/products/virtualized-services-platform/

Mellanox end-to-end Ethernet connectivity:

http://www.mellanox.com/ethernet-storage-fabric/

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