Express Virtio - XVIO

PERFORMANCE OF SR-IOV; AGILITY AND HARDWARE INDEPENDENCE OF VIRTIO

XVIO BRINGS AN INCREDIBLE BALANCE BETWEEN PERFORMANCE, MOBILITY AND RESOURCE UTILIZATION TO PUBLIC AND PRIVATE CLOUD IAAS END USERS AND OPERATORS ALIKE.

Express Virtio (XVIO) is a standards-based technology that delivers the highest networking performance, mobility and server resource utilization for Virtio-based virtual machine (VM) workloads. It provides SR-IOV and bare metal-like networking performance to VMs enabling maximum server infrastructure utilization in cloud IaaS deployments. XVIO combines standards-based and open source networking technologies namely DPDK, SR-IOV and Virtio in an innovative way to bring unprecedented data center efficiencies.

With XVIO, cloud data center and Telco service providers can now make its customers' VM on-boarding experience fast and seamless while delivering networking performance to VMs at levels never seen in the past. Service providers can seamlessly migrate customer VMs across servers with no downtime.

XVIO technology is now available with Netronome's Agilio® CX and LX SmartNICs, Agilio OVS Software, Agilio OVS Firewall Software and Agilio vRouter Software products. XVIO technology will be available with Agilio CoreNIC software products in the future. XVIO capabilities with the above products can be utilized to deliver sophisticated networking services to VMs including multi-tenancy, service chaining, stateless and stateful policy rules, per-flow network analytics and load balancing.

XVIO AS COMPARED TO DPDK AND SR-IOV

OpenStack networking is implemented mostly using server-based networking components such as Linux Bridge, Linux Firewall, Open vSwitch (OVS) and Contrail vRouter. These Linux networking software components run on x86 CPU cores and deliver various levels of networking and security services to VMs. When these components run in the Linux kernel, the networking performance delivered to applications running in VMs is inadequate and many CPU cores are consumed when executing these networking functions, starving the VMs and their applications. Performance is impacted both in terms of throughput and latency. Overall, server efficiency is impacted adversely. DPDK and SR-IOV are two technologies that are used to alleviate some of these challenges. They are discussed in this document.

When SR-IOV is used, the Linux networking stack in the host is bypassed delivering high networking performance to VMs. Performance in terms of throughput and latency are improved significantly. However, the rich networking and security services provided by those Linux networking software components (such as OVS and Contrail vRouter) are lost. SR-IOV requires networking hardware (NIC) dependent device drivers in the VMs making onboarding of customer VMs difficult or impossible. Infrastructure agility and efficiency are sacrificed because VM migration across servers cannot be supported.

DPDK enables some of the Linux networking software options such as OVS and Contrail vRouter to be executed in the Linux user space, eliminating some of the overheads running the same components in the kernel space. As a result, performance – both throughput and latency - delivered to VMs is improved to some degree, compared to running the same components in the kernel. Networking and security services provided by OVS and Contrail vRouter are available. However, CPU cores are still consumed when executing these functions in the DPDK user space. Networking software such as Linux Firewall and Connection Tracking (Conntrack) used for stateful security policies run in the kernel and cannot be utilized with DPDK.

XVIO, when used with Netronome's products – Agilio CX and LX SmartNICs, Agilio OVS Software, Agilio OVS Firewall Software and Agilio vRouter Software products – eliminate the above challenges.

KEY BENEFITS OF XVIO

XVIO delivers benefits in three key areas:

XVIO delivers optimum performance and flexibility related to on-boarding customer VMs and virtual network functions (VNFs). This includes the ability to support live VM migration. The figure below shows this benefit offered by XVIO as compared to Virtio, SR-IOV and DPDK.
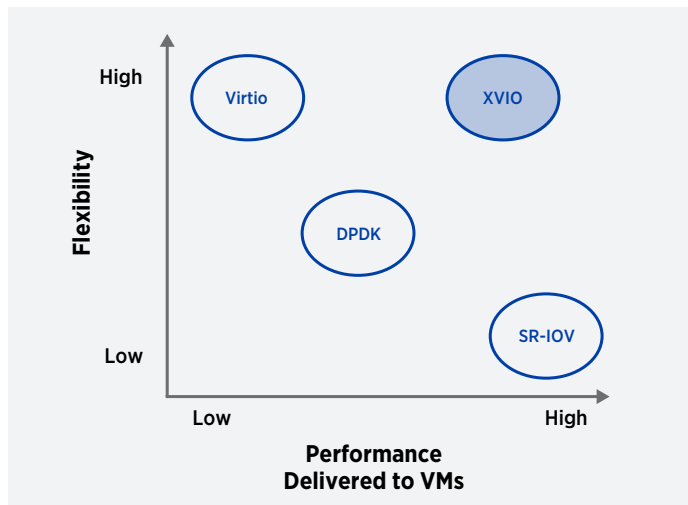
XVIO enables performance similar to SR-IOV while delivering rich networking services available with networking software such as OVS, Conntrack/Linux Firewall and Contrail vRouter. The figure in the top right shows this benefit offered by XVIO as compared to Virtio, SR-IOV and DPDK.
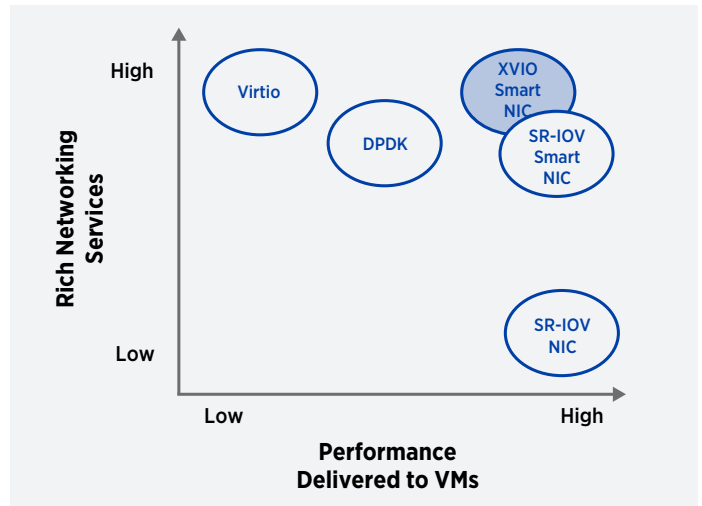
XVIO achieves the highest server efficiency through CPU core savings, freeing them up for applications and VMs. The figure below shows this benefit offered by XVIO as compared to Virtio, SR-IOV and DPDK.
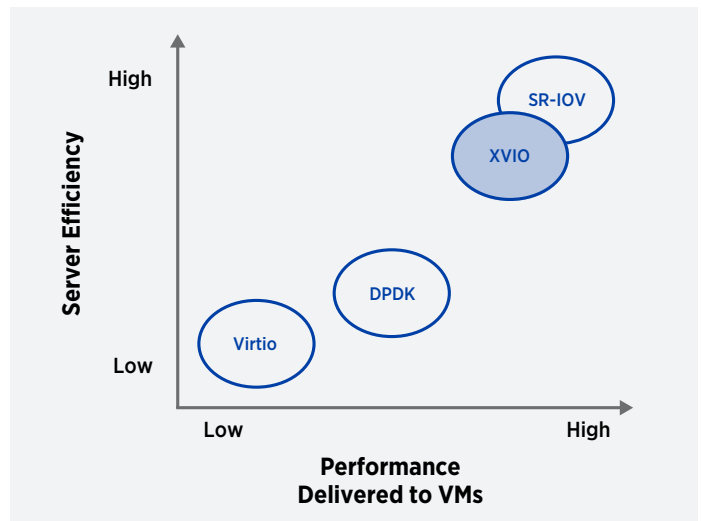
XVIO ENABLED PRODUCTS

Agilio software products provide seamless OpenStack, Open Daylight and Contrail orchestration of virtual networking.

Agilio OVS Software

Agilio OVS Software, combined with Agilio SmartNICs, significantly improves server-based networking performance and restores valuable CPU cores by offloading OVS and Linux networking functions to the SmartNICs. The Agilio solution is a drop-in accelerator for OVS with seamless integration, making it compatible with existing network tools and controllers. This, combined with XVIO, now brings the same performance to Virtio-based VM workloads.

Agilio OVS Firewall Software

The Agilio OVS Firewall Software is designed to enable zero-trust stateful security in data centers using OpenStack-based automation. Agilio OVS Firewall Software, combined with Agilio SmartNICs, enables zero-trust stateful security while significantly improving server-based networking performance. Agilio OVS Firewall Software restores valuable CPU cores by offloading OVS and Conntrack to the SmartNICs. This gives users the ability to define more intelligent filtering policies, security groups, access control lists and stateful firewall applications. The solution is a drop-in accelerator for OVS, making it compatible with existing network tools, controllers and orchestration software. This, combined with XVIO, now brings the same security and performance to Virtio-based VM workloads.

Agilio vRouter Software

Agilio vRouter Software, combined with Agilio SmartNICs, significantly improves server-based networking performance and restores valuable CPU cores by offloading the vRouter datapath to the SmartNICs. It is designed to enable advanced forwarding functions such as L3 forwarding, underlay/overlay, VPN and tunnel encapsulations in data centers using Contrail-based automation. This, combined with XVIO, now brings the same functionality, performance and offload advantages to Virtio-based VM workloads.

The combination of Agilio products with XVIO enables many use cases including zero-trust stateful security, software-defined networking (SDN) gateways for tunnel termination, on-boarding high performance customer VMs on IaaS and VNFs requiring specific tunnel termination performance provided by server-based networking infrastructure.

XVIO BENCHMARKS

XVIO with Agilio OVS and Agilio CX SmartNICs delivers 24Mpps. This includes a significant number of policy rules and VXLAN tunneling. XVIO with Agilio vRouter and Agilio CX SmartNICs delivers 20Mpps. This includes a significant number of policy rules and VXLAN or MPLS over GRE tunneling. Please contact Netronome for further details on benchmarking methodologies utilized.

CONCLUSION

XVIO brings an incredible balance between performance, mobility and resource utilization to public and private cloud IaaS end users and operators alike. The high performance Virtual I/O technology, leveraging key open and standards based technologies like Virtio, DPDK and SR-IOV, XVIO technology, can be used for new cloud data center architectures.

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