Virtual High Performance Computing

HPC for the traditional data center

"Virtualization technologies allow HPC and other workloads to leverage resources ever more efficiently and allow more scalability by bursting into the cloud. For example, VMs are a convenient way to package and deploy scientific applications across heterogeneous systems. Applications can be packaged with their required libraries and support programs, including a distributed file system that would otherwise be difficult or impossible to install without special privilege.."

—A benefit of vHPC

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VMware vSphere 6.5
VSAN 7
HORIZON VIEW 7
NSX

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Virtual Resource and Data Control

In the past, many would say that you simply can't virtualize high-performance computing workloads. They require dedicated sets of resources, the workloads themselves are very heavy, and a lot of architectures never took virtualization into consideration.

The modern hypervisor has come a long way. So, if you're in the HPC world and are still skeptical about creating a vHPC cluster, consider some of the following. It's important to explain here what it means to run compute-intensive code on a modern hypervisor. Because of direct para virtualization optimizations, the vHPC clustered workload is basically running on the bare metal architecture.

Rugged Cloud has developed a fully integrated vHPC cluster solution utilizing VMware vSphere on Intel V4 Hyper Converged x86 systems with Samsung NVMe storage devices horizontally scaled over a Mellanox 100Gbe fabric switch.

The Rugged Cloud vHPC Cluster

The Rugged Cloud vHPC solution brings together the best of breed technologies into a highly scalable Hyper Converged HPC cluster supporting both VMware VSAN and RedHat HPC Clusters a well as RedHat CEPH into a fully operational High Performance Cluster.

The vHPC cluster integrates RHEL Linux HPC VM's using VMware VSAN as the shared storage component.

ruggedcloud

As one of the highest-performing platforms available, Red Hat Enterprise Linux is frequently chosen to run industry benchmarks that showcase leadership in diverse areas like vHPC computational scalability, application performance, and database throughput

RED HAT®
CEPH STORAGE

Mellanox
TECHNOLOGIES

SN2100 – 100Gbe Open Ethernet Switch

SAMSUNG

PM1725 NVMe PCIe SSD

Cutting-edge flash memory leveraging V-NAND technology. PM1725 empowers the highest density to successfully process intensive and heavy enterprise workloads.

How it Works

The vHPC cluster is essentially two Software Defined Data Center clusters in a RCS-VHPC-Cluster system of systems. The vHPC Cluster combines multiple virtual workloads into a common Hyper Converged Infrastructure hardware cluster using Samsung NVMe storage devices over an Mellanox 100Gbe cluster fabric. VM's are deployed across a VMware NSX SDN which provides a fully converged micro-segmented virtual machine network.

The vHPC cluster also employee's VMware Horizon VIEW where RHEL Linux desktops have been fully virtualized.
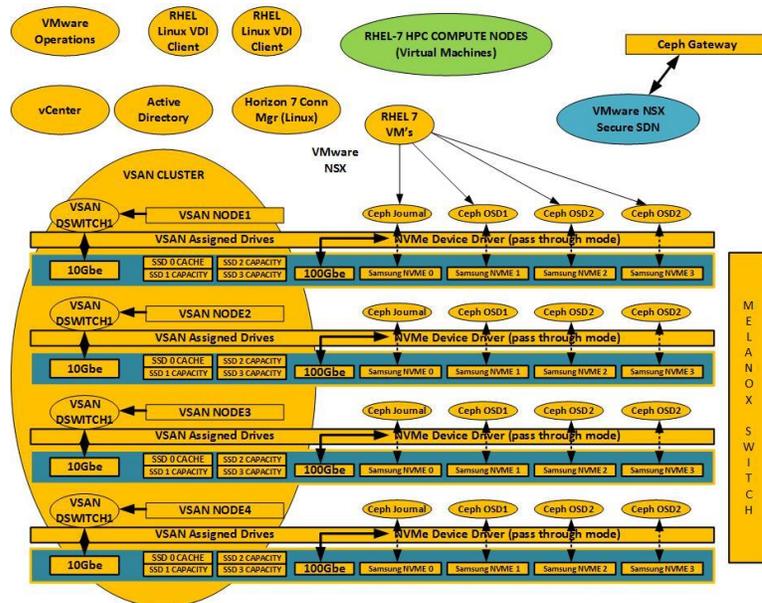
vHPC Performance

Benchmarks performed using HCIBENCH produced the following results per VM.

# VM's	IOPS	TPUT	LATENCY	R-LAT	W-LAT	CPU	MEM
100	49,943	195MB	5.7ms	5.8ms	5.6ms	34.9%	17.8%

vHPC Security

Cluster wide security is provided by Rugged Clouds patented security architecture based on Network Virtual Memory/Secure. VM instructions and memory are fully protected against attacks and malicious code using memory and instruction set isolation.