



# QxStack CNS Infrastructure for VMware Enterprise PKS

The Most Reliable, Simple, and Secure Kubernetes Based Solution to Accelerate Your Digital Transformation

## Main Challenges

- Require speedy, lightweight, and portable development environment
- Face the problem of secondary development with open source Kubernetes.
- High complexity of mixed infrastructures that impact the visibility and manageability of network across different workloads.

## QCT's Value

- Validated solutions that benefits customers to accelerate time to market
- Optimized SKUs to build modernized cloud-native infrastructure
- Close relationship with technology partners to jointly deliver the latest technologies

## INTRODUCTION

With the popularity of novel applications such as mobile banking and phone-based applications, legacy development approach is no longer to be able to meet the requirements of rapid digital transformation. Cloud-native or container-based application is a trendy approach adopted to provide speedy, lightweight, and portable development environment. Kubernetes is a container-orchestration system which is commonly used to deploy and manage containerized applications. However, developing apps with open source Kubernetes requires rich experience and high investment in learning. Furthermore, enterprises often face the problem of secondary development in the DevOps process when using components proposed by open community such as CNCF. They might struggle to fix the errors without on-demand technical supports. This situation not only consumes time but also increases risks due to the leakage and complex system.

VMware, and Pivotal developed a production-grade Kubernetes orchestration platform, VMware Enterprise PKS. VMware Enterprise PKS features high availability (HA), auto-scaling, built-in health checks, auto-healing, and rolling upgrades to ease the pain of deploying the complex platform. Meanwhile, it is compliant with the latest Kubernetes version that allows enterprises to use new functions and tools. VMware NSX-T also enhances the visibility and manageability so that constructing and maintaining networks becomes easy with its advanced Software-Defined Network (SDN) functions.

Quanta Cloud Technology (QCT) launches **QxStack CNS Infrastructure for VMware Enterprise PKS** by integrating in-house Hyper-Converged Infrastructure (HCI) servers with VMware Enterprise PKS to provide a stable Cloud-Native Service (CNS) infrastructure. QCT and VMware collaborated to define reference architecture, troubleshoot technical issues, and optimize the overall performance of VMware Enterprise PKS. This solution can highly accelerate the deployment process for cloud-native and container-based infrastructure and speed your time to market.

## VMWARE ENTERPRISE PKS ARCHITECTURE

VMware Enterprise PKS is deployed on vSphere® and vSAN™ environment running on standard HCI servers, as shown in *Figure 1*. VMware Enterprise PKS consists of BOSH director, Kubernetes, Harbor®, and NSX-T Data Center to provide a production-grade container-based development environment monitored by vRealize Suite and Wavefront.

BOSH is a tool utilized to deploy and maintain Kubernetes clusters. It simplifies the deployment and lifecycle management of Day-1 operation for large-scale distributed systems, allowing users to focus on Day-2 operation. Users can deploy Kubernetes on heterogeneous platforms such as AWS, Microsoft Azure, Google Compute Platform, and OpenStack. On the other hand, Kubernetes is in charge of automatically utilizing and managing resources for container orchestration. Harbor® is another tool that stores and manages the container images with the functions such as vulnerability scanning and policy-based image replication.

The networking environment is realized with the advanced SDN tool, VMware NSX-T Data Center. NSX-T is capable of implementing the hardware-agnostic overlay networks on clouds in which the overlay network provides services from Layer 2 to Layer 7 on demand. With the functions of NSX-T such as micro-segmentation, load-balance, distributed firewall, and security policy, the visibility and manageability of the networking is enhanced to provide an easy-management and secure environment for multi-tenancy.

vRealize Suite is used to deploy, monitor, and control the system. Wavefront can monitor health status across all hierarchy levels, analyze the containers and services, and display programmatic alert on a customizable dashboard.

### Solution Benefits

- Production-grade Kubernetes orchestration platform that simplifies deploy and maintenance processes
- VMware NSX-T enhances the visibility and manageability for networking and ensures security for multi-tenancy
- BOSH allows users to deploy Kubernetes on heterogeneous platforms.
- Validated and optimized CNS infrastructure solution that guarantees the performance and speed up time to market

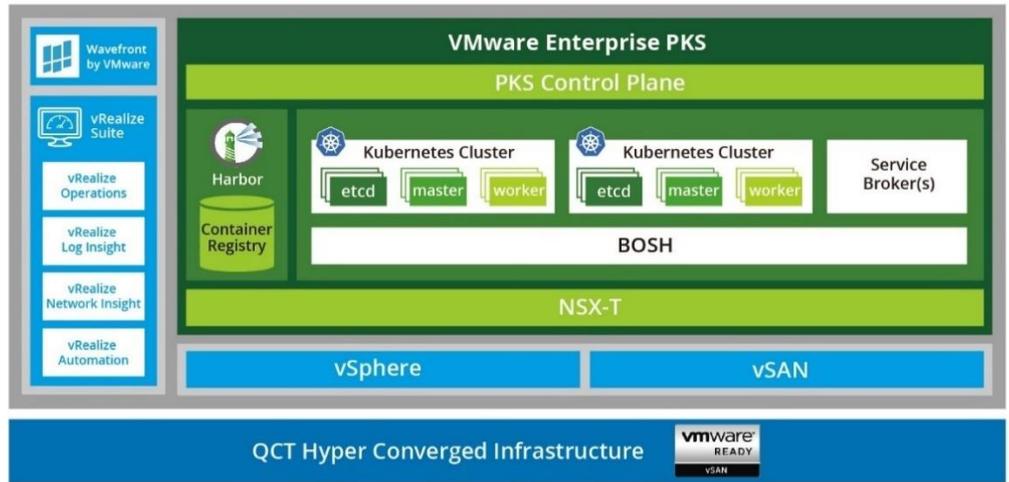


Figure 1. VMware Enterprise PKS Architecture.

### QxStack CNS Infrastructure Architecture

In this solution, the three-cluster design, including management, compute, and edge clusters is recommended to deploy VMware Enterprises PKS in which each cluster corresponds to one vSphere cluster, as shown in Figure 2. To better select and utilize hardware resources, the function blocks can be separated into different clusters based on the roles. Meanwhile, IT administrators can flexibly allocate software and hardware resources according to the specific functionality of each cluster and can easily scale out the cluster by adding extra nodes.

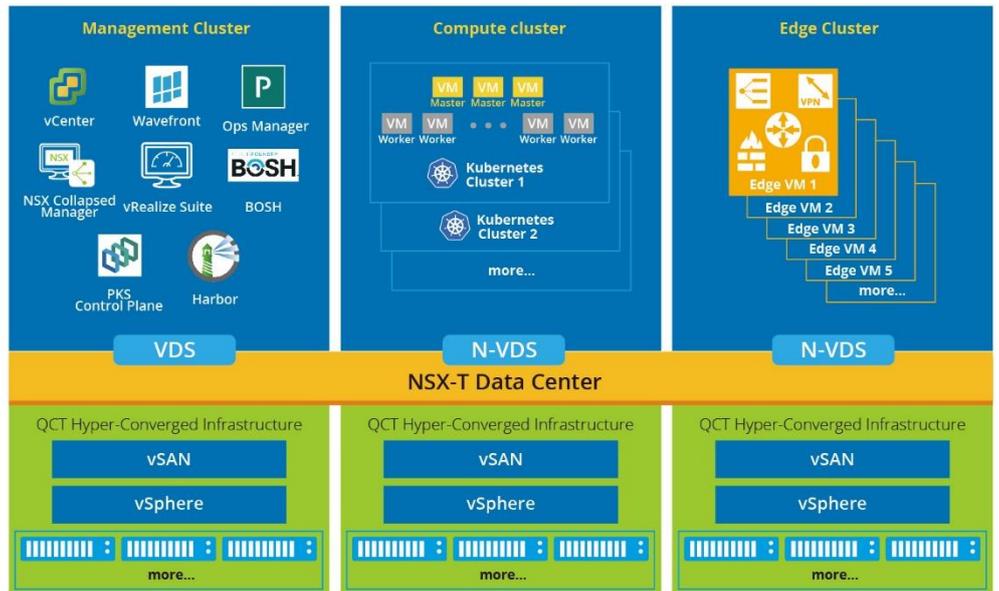


Figure 2. Three Cluster Design.

#### Management Cluster

The management cluster is in charge of overall management, monitoring, and operations of the infrastructure and workloads resources. Management appliances such as vCenter server, NSX collapsed manager, vRealize Suite (e.g., VMware® vRealize Operations Manager™, vRealize® Network Insight™, vRealize® Log Insight™, and vRealize® Automation™), and Wavefront can be deployed in this cluster. Other appliances such as Ops Manager, BOSH agent, PKS Control Plane, and Harbor registry are allocated to build, orchestrate, and manage resources for Kubernetes. Users can also deploy and manage Kubernetes clusters on public clouds through this cluster.

### Compute Cluster

The compute cluster is in charge of hosting containers and running workloads, like MySQL or Mango DB. Multiple Kubernetes clusters can be deployed in one compute cluster. For production environment, each Kubernetes cluster consists of three master nodes and multiple worker nodes for HA. In addition, the higher level of HA, such as zero downtime, can be achieved by adopting multiple availability zones (AZs). The approach of multi-AZ design is detailed in the reference architecture proposed by VMware.

### Edge Cluster

The edge cluster is in charge of connecting Kubernetes and external network for the north-south traffic. It hosts NSX-T edge nodes for providing Virtualized network functions (VNFs) such as DHCP, NAT, N-S firewall, multi-tenancy routing model, VPN, and load balancer which can bring the flexibility of network design for cloud-native workloads. The edge cluster can be either deployed on bare metal or VM form factors for different workloads.

## HARDWARE SUGGESTION

In order to ensure the performance and stability, QCT discreetly selects hardware components, firmware, driver, and the software stack to guarantee the compatibility between servers and software. A series of QCT servers with [VMware vSAN ReadyNode™](#) certified are recommended for different VMware solutions. With the certified infrastructure, administrators can save considerable time on verifying hardware performance and compatibility which speeds up your time to market and reduces the total cost of ownership (TCO). Considering the requirements of the workloads, three recommended servers are shown in Table 1.

Table 1. Recommended Servers.

	Compute cluster and Edge cluster		Management cluster
<b>Server Model</b>	QuantaGrid D52B-1U 	QuantaGrid D52BQ-2U 	QuantaPlex T42S-2U 
<b>Form Factor</b>	1U	2U	2U
<b>CPU per Node</b>	2 x Intel® Xeon® Scalable Processors Platinum/Gold/Silver Series		
<b>Memory</b>	Up to 24 slots		Up to 16 slots per node
<b>Driver Bays</b>	12 x 2.5" hot-plug (All NVMe support)	24 x 2.5" hot-plug 12 x 3.5" hot-plug (NVMe support)	(24) 2.5" hot-plug
<b>vSAN Profile</b>	AF – 4,6,8 HY – 2,4,6,8	AF – 4,6,8 HY – 4,6,8	AF – 4,6 HY – 4,6
<b>PCIe Slots</b>	Up to 5 slots	Up to 10 slots	2 slots per node

### Hardware for Management Cluster

Since the management cluster is responsible for overall management, the fault tolerance design for compute, storage, and network is essential in this cluster. According to [VMware® vSAN™ Design and Sizing Guide](#), four or more nodes in a vSAN cluster are suggested to provide great flexibility to accommodate storage failure.

QCT multi-node server, QuantaPlex T42S-2U, is a 2U four-node server in one chassis which conforms the four-node recommendation for vSAN. Compared to regular 1U servers, QuantaPlex T42S-2U provides double compute density which can save space for other uses. Moreover, each node is equipped with 2 PCI Express (PCIe) slots for NICs which ensure HA for networking. The easiness to implement a vSAN cluster in one server chassis makes this server model an ideal choice to build the management cluster.

## Hardware for Compute Cluster

Workload is the most important feature for building a compute cluster. Business critical applications such as bank's transaction process generally require high IOPS performance; hence, multi-UPI or NVMe SSD are recommended to be adopted. Moreover, multiple PCIe expansion slots can provide more flexibility for network functions such as uplink on N-VDS (S) and N-VDS (E) or other expansion cards. QuantaGrid D52B-1U is an ultra-dense server with up to 5 PCIe expansion slots per chassis. It supports 2 Intel® Xeon® Scalable Processors and 12 NVMe SSDs to maximize IOPS performance. On the other hand, QuantaGrid D52BQ-2U features high storage capacity and provides up to 10 PCIe expansion slots with various PCIe lane widths in a 2U chassis to accommodate different speeds of NIC as well as provide extensibility for other functions.

## Hardware for Edge Cluster

The NSX-T Edge node can be deployed in VM or bare metal form factor in the edge cluster. When the edge VM form factor is implemented, at least two physical NICs are suggested to be installed for redundancy. Compared to the VM form factor, NSX-T Edge node running on bare metal form factor can shorten failover time and provide greater throughput for production-grade applications. In bare metal mode, according to [NSX-T Data Center Installation Guide](#), at least three physical NICs are suggested. One dedicated NIC is retained for management while the other two NICs are respectively allocated for overlay tunneling traffic and VLAN uplink connectivity. The server with multiple PCIe slots for physical NICs can ensure flexibility and redundancy for uplink assignment. With up to 5 and 10 PCIe expansion slots respectively, QuantaGrid D52B-1U and D52BQ-2U are both qualified for deploying VM or bare metal form factor, providing elasticity and reliability of network functions.

## Conclusion

Cloud native and container-based applications are utilized to cope with the fast-changing world. VMware Enterprise PKS is a comprehensive solution that simplifies operation and management, provides cross-environment ability, and enhances security of Kubernetes platform. In this solution brief, QCT collaborated with VMware to validate the performance of PKS on QCT HCI servers and proposed **QxStack CNS Infrastructure for VMware Enterprise PKS**, a pre-validated and optimized production-grade Kubernetes infrastructure solution, to help you accelerate your digital transformation.

## ABOUT QCT

Quanta Cloud Technology (QCT) is a global data center solution provider. We combine the efficiency of hyperscale hardware with infrastructure software from a diversity of industry leaders to solve next-generation data center design and operation challenges. QCT serves cloud service providers, telecoms, and enterprises running public, hybrid and private clouds.

Product lines include hyperconverged and software-defined data center solutions as well as servers, storage, switches and integrated racks with a diverse ecosystem of hardware components and software partners. QCT designs, manufactures, integrates and services cutting-edge offerings via its own global network. The parent of QCT is Quanta Computer, Inc., a Fortune Global 500 corporation.

<http://www.QCT.io>

## ABOUT VMware

VMware software powers the world's most complex digital infrastructure. The company's compute, cloud, mobility, networking and security offerings provide a dynamic and efficient digital foundation to over 500,000 customers globally, aided by an ecosystem of 75,000 partners. Headquartered in Palo Alto, California, this year VMware celebrates twenty years of breakthrough innovation benefiting business and society.

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