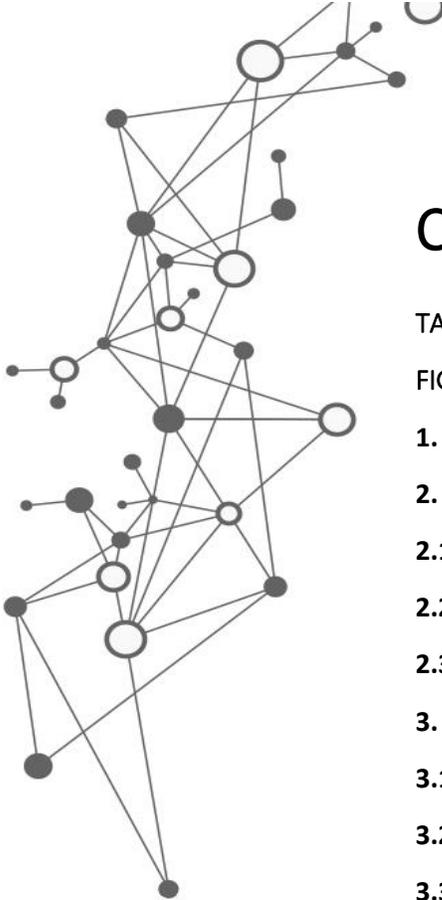


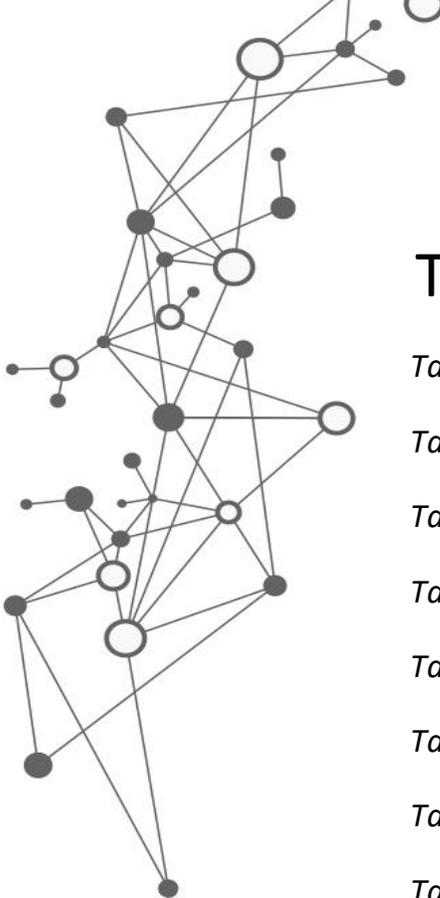
QxVDI-VMware Edition 3D Reference Architecture





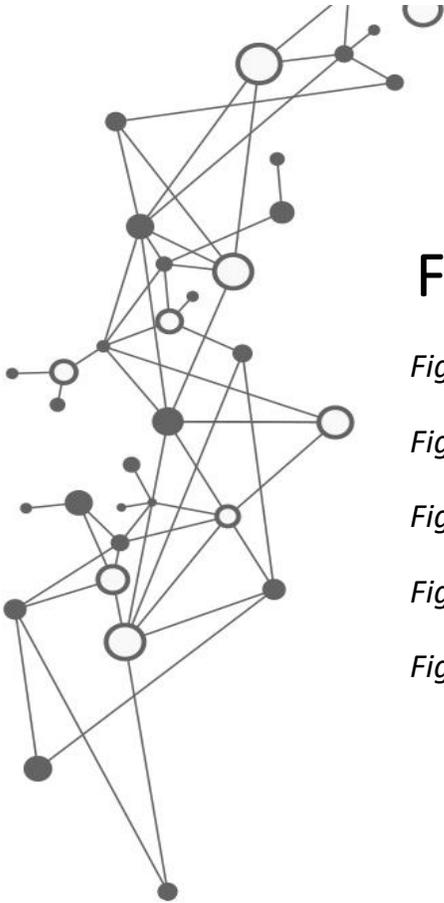
CONTENT

TABLES	2
FIGURES.....	3
1. EXECUTIVE SUMMARY	4
2. INTRODUCTION	5
2.1. Purpose	5
2.2. Scope.....	5
2.3. Audience.....	5
3. SOLUTION OVERVIEW.....	6
3.1. Manageability, Scalability, and Efficiency – Hyper-Converged Infrastructure.....	6
3.2. Security in Virtual Desktop Infrastructure	6
3.3. Economical Total Cost.....	7
3.4. User Experience Enhancement.....	7
4. SOLUTION ARCHITECTURE	8
4.1. Hardware Configuration	8
4.2. Software	9
4.2.1. <i>NVIDIA GRID™</i>	9
4.2.2. <i>VMware vSphere®</i>	10
4.2.3. <i>VMware vSAN™</i>	10
4.2.4. <i>VMware Horizon®</i>	11
5. SOLUTION VALIDATION	12
5.1. Virtual Desktop Infrastructure (VDI) Test.....	12
5.1.1. <i>Test Overview.....</i>	12
5.1.2. <i>Test Configuration.....</i>	13
5.1.3. <i>Test Result.....</i>	13
5.2. 3D Workload Validation Test.....	14
5.2.1. <i>Test Overview.....</i>	14
5.2.2. <i>Test Configuration.....</i>	15
5.2.3. <i>Test Result.....</i>	15
6. CONCLUSION.....	16
7. REFERENCE.....	17
LEGAL DISCLAIMER.....	17



TABLES

<i>Table 1. Solution Hardware Configuration.</i>	<i>9</i>
<i>Table 2. Solution Software Configuration.</i>	<i>9</i>
<i>Table 3. Virtual GPU Types for P100.</i>	<i>10</i>
<i>Table 4. VMware Horizon® Software Features.</i>	<i>11</i>
<i>Table 5. Login VSI Official Rating of Performance Score.....</i>	<i>12</i>
<i>Table 6. Login VSI Official Workload Profiles.</i>	<i>12</i>
<i>Table 7. VM Profiles for VDI Test.</i>	<i>13</i>
<i>Table 8. Test Result of VDI Test.....</i>	<i>14</i>
<i>Table 9. VM Profiles for 3D Workload Validation Test.</i>	<i>15</i>
<i>Table 10. Test Results for 3D Workload Validation - Test Case 2-6.....</i>	<i>15</i>



FIGURES

<i>Figure 1. Comparison between Traditional Architecture and HCI.</i>	<i>6</i>
<i>Figure 2. QxVDI 3D Reference Configuration.</i>	<i>8</i>
<i>Figure 3. VDI Testing Topology.</i>	<i>13</i>
<i>Figure 4. Test Result of VDI Test.</i>	<i>14</i>
<i>Figure 5. Test Result of 3D Workload Validation Test.</i>	<i>15</i>

1. Executive Summary

In the fast-changing business world, IT system design nowadays is essential to meet the diversified demands. CTOs are concerned about the resources utility, low total cost of ownership (TCO), and system security in terms of IT infrastructure. Administrators consider that high efficiency of system management process can increase productivity. End users are concerned about the overall user experience such as the system performance with flexible access.

To fulfill the demands from different aspects, Quanta Cloud Technology (QCT), a global data center solution provider, provides ready-to-use software-defined VDI solutions. QxVDI-VMware Edition Series is a virtual desktop infrastructure (VDI) solution product line which contain three solutions for different target scenarios: 1) QxVDI-OA is a solution designed for light and medium workload (e.g., office applications). 2) QxVDI-HC is a solution designed for high computing workload (e.g., laboratory usage). 3) QxVDI-3D is the solution this reference architecture mainly focuses, particularly for the scenarios of Graphic design. The benefits of this solution are listed below.

- Thorough information protection: enhance system and data security by the centralized system control, self-destroying and self-reassembly VMs, and key policy management.
- Efficient resource utility: maximize the utilization of compute and GPU resources with hyper-converged structure and resource virtualization
- Effective manageability: enhance and simplify the equipment manageability by the centralized control of virtual desktop environment so as to reduce the operation expense (OpEx).
- Outstanding user experience: provide users flexible access to system anytime, anywhere and improve team productivity by session collaborations.

In this document, QCT validated and proved the feasibility of the solution architecture to provide virtual desktop environment with virtual GPU resources and execute 3D applications on virtual desktop environment. QCT believes that QxVDI-3D is a valid choice for partners and customers to construct virtual desktop infrastructure (VDI) and stay in a leading position.

2. Introduction

2.1. Purpose

The purpose of this reference architecture is to introduce QxVDI-3D and validate the solution's capability to provide virtual desktop environment with virtualized GPU resources and the feasibility to run diverse 3D applications in virtual desktop environment.

2.2. Scope

This reference architecture is to:

- Introduce the overall structure of QxVDI-3D and the benefits of this solution.
- Illustrate the hardware configuration and software stack discreetly selected by QCT in the solution.
- Simulate the virtual desktop environment on the infrastructure and 3D workloads running on VDI, and demonstrate the feasibility and capability of QxVDI-3D under the two simulated scenarios.

2.3. Audience

The intended audience of this document are IT professionals, technical architects, and sales engineers who would like to replace traditional workstation and adopt software-defined infrastructure to build VDI.

3. Solution Overview

3.1. Manageability, Scalability, and Efficiency – Hyper-Converged Infrastructure

QxVDI-3D is a hyper-converged infrastructure solution. Traditionally, IT technicians face the challenges of resource management and scalability since compute and storage resources are separated. Hyper-Converged Infrastructure (HCI) is a novel technology which can integrate compute, storage, and virtualization resources in a single hardware box. Every single node is capable of delivering compute and storage resources at the same time. Several benefits are listed in detail below.

Simplified Management

In the legacy-converged architecture, since compute and storage resources are provided by different servers and storage devices, the configuration settings and operation management are independent, which means IT administrators must manage two devices through different management tools. To provide a storage device to a server, users need to configure settings from LUN and Volume, and then mount the storage device to the server host for VM to access. In the hyper-converged architecture, compute and storage can be regarded as a system. Users can manage both compute and storage resources with a single management portal. By achieving full “policy-driven management”, IT administrators only need to define their own compute and storage resources. The allocation process can be automatically completed by a single management portal, which significantly reduces the management effort.

Scalability and Efficiency

The hyper-converged infrastructure integrates compute and storage resources into a basic unit, called building block. By implementing the clustered architecture, users can add more building blocks to the cluster to expand the overall performance and capacity. This also makes the expansion of the hyper-converged architecture simple and predictable, as shown in Figure 1.

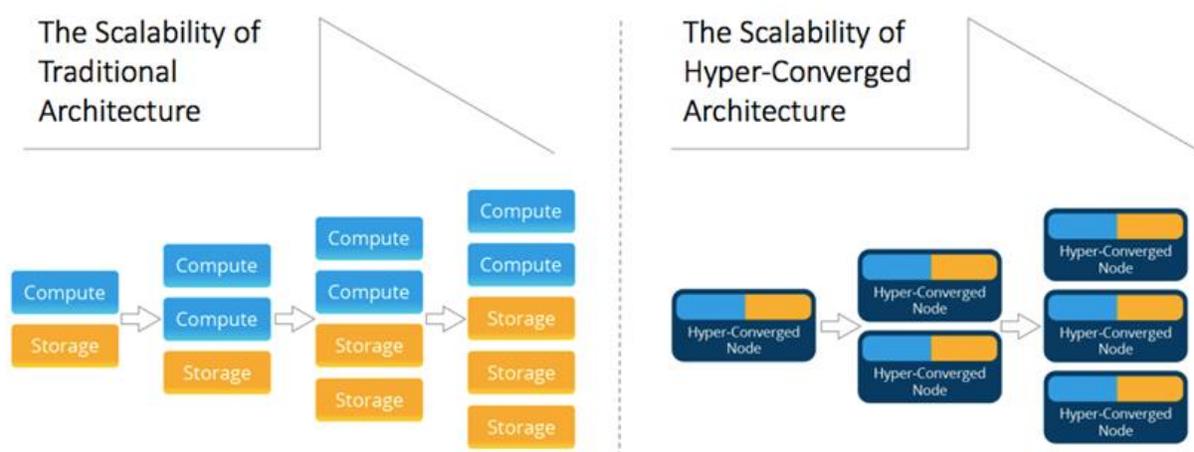


Figure 1. Comparison between Traditional Architecture and HCI.

3.2. Security in Virtual Desktop Infrastructure

Under the trend of digitalization, information security is one of the greatest considerations to prevent unauthorized access. Customers need to put more attention and efforts to protect their data and system. With

VMware Horizon, QxVDI-3D provides multiple security functions in virtual desktop environment. Customers can enable and disable the system setting based on not only authorization but also on variables such as USB access and printing, and client-driven redirection. On the other hand, the desktop is respectively destroyed and reassembled every time when users log out and log in. No matter the malware is inadvertently or intentionally activated in a desktop, the malware could be destroyed when the user logs out.

3.3. Economical Total Cost

QxVDI-3D can provide economical TCO in both Capacity Expense (CapEx) and Operation Expense (OpEx).

Capacity Expense Saving

The utilization of GPU plays a great role in CapEx saving. Considering the high price of GPU, it is important to make precise calculation of GPU resource for different scenarios and business needs. With the benefit of virtualization, customers can fully utilize GPU by sharing its resource and releasing the GPU resource when there is no demand. Traditionally, customers need to invest a large amount of money in purchasing several high-end workstations, resulting in highly affecting the cash flow of the company. However, with QxVDI-3D, customers can address the 3D-related work with just several basic-level computers and save up to 46% of the CapEx invested in hardware.

Operational Expense Saving

Traditionally, customers need to deploy new applications or execute version upgrade of applications one computer by one computer. This can result in time-consuming and waste of manpower. With QxVDI-3D, the system can bring high-efficient reaction to fulfill the demands of front-end business. Customers can save lots of efforts in managing a system by the centralized system control from application deployment to version upgrade to troubleshooting.

3.4. User Experience Enhancement

Remote access

In the fast-developing world, global mobility is a basic skill for professionals. The flexibility of work places need to keep track of global mobility development. Traditionally, user's time and productivity are restricted by working hours and working places. With QxVDI-3D, users can access the virtual desktop environment remotely anytime, anywhere; therefore, users can flexibly manage their time and unleash their productivity when the moment of inspiration suddenly comes.

Session Collaboration

Session Collaboration is a function that users can share a virtual desktop to multiple colleges so that they can communicate efficiently and reach agreement speedily. This function is especially useful for remote technical support, design discussion, software development, and medical diagnosis.

4. Solution Architecture

The solution, QxVDI-3D, is composed of QCT's GPU servers and VMware software. The overall solution architecture is shown in Fig. 2 below.

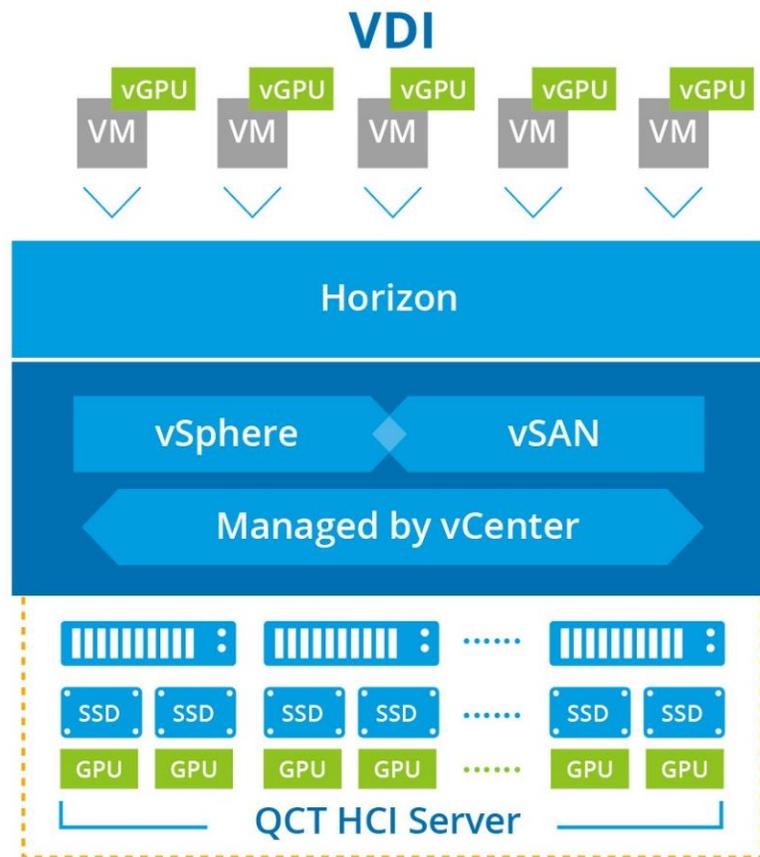


Figure 2. QxVDI 3D Reference Configuration.

4.1. Hardware Configuration

In the QCT QxVDI-3D SKU, the server QuantaGrid D52BV-2U is adopted as the infrastructure which breaks through the hardware configuration limitations in a 2U dual-socket system. The server can support up to four graphic accelerator cards, 3TBs of memory, and 8 large form factor storage bays, which make D52BV a perfect versatile platform for parallel computing-intensive applications such as VDI, HPC, and AI/Deep learning. Some important features of QuantaGrid D52BV-2U are listed below:

- QuantaGrid D52BV-2U supports dual Intel® Xeon® scalable process family processor of the highest Thermal Design Power (TDP).
- QuantaGrid D52BV-2U supports utmost four dual-width graphic accelerator cards and 24 DIMM slots which is particularly suitable for VDI solutions.
- Eight 3.5" HDD support provides local storage space for rendering application.
- 4xU.2 option eliminates I/O latency to expedite deep learning model training.

The components in this QxVDI-3D are carefully evaluated and selected, as show in Table 1 below:

Table 1. Solution Hardware Configuration.

Role	Component	Quantity
Server Model Name	QuantaGrid D52BV-2U	4
CPU	Intel Xeon Gold 6134	8
Memory	32GB DDR4-2400	24
Cache Tier	2.5" SATA 960GB	8
Capacity Tier	2.5" SATA 3.84TB	24
Storage Controller	SAS 3008 mezzanine	4
GPU card	NVIDIA P100 16GB PCIe	4
Network Interface Card	Quanta 82599 dual port 10Gb, SFP+	4
Boot Device	SATADOM 32GB	4

4.2. Software

The software stack utilized in this solution includes the VMware vSphere®, VMware vSAN, and VMware Horizon®. The adopted versions are listed in Table 2.

Table 2. Solution Software Configuration.

Software and Service	Version
VMware vSphere®	6.7
VMware vSAN™	6.7
VMware Horizon®	7.4
vCenter Server® Appliance	6.7

4.2.1. NVIDIA GRID™

NVIDIA GRID™ is a GPU virtualization software provided by NVIDIA which can deliver GPU-acceleration to every virtual machine by virtualizing the resource of physical GPU cards. The primary features of NVIDIA GRID™ are:

- GPU virtualization for virtual desktop – vGPU is virtualized GPU resources for guest operating system which provides GPU memory and time slice of the GPU compute power for each VM.
- Major guest operating systems such as MS Windows and Linux OS are supported.
- GPU pass-through mode – direct access from VM to the GPU hardware is supported for GPU intensive applications.
- Guaranteed Quality-of-Service (QoS) – GPU scheduling options include fixed share, equal share, and best effort/time slicing.
- 4K display support for VM.

NVIDIA GRID defines several virtual GPU types, which indicate different amount of resource allocated to each VM for different target users. In this solution, QCT chose the GPU card P100 and the virtual GPU types are shown in Table 3.

Table 3. Virtual GPU Types for P100.

Virtual GPU Type	Target User	Frame Buffer (Mbytes)	Virtual Display Heads	Maximum Resolution per Display Head	Maximum vGPUs per GPU	Maximum vGPUs per Board
P100X-16Q	Designer	16384	4	4096 x 2160	1	1
P100X-8Q	Designer	8192	4	4096 x 2160	2	2
P100X-4Q	Designer	4096	4	4096 x 2160	4	4
P100X-2Q	Designer	2048	4	4096 x 2160	8	8
P100X-1Q	Power User, Designer	1024	2	4096 x 2160	16	16

4.2.2. VMware vSphere®

VMware vSphere® is the leading virtualization software for cloud foundation. The primary features of the VMware vSphere® are:

- Server virtualization: VMware ESXi™ hypervisor virtualizes server's hardware into manageable resources.
- Centralized management: vCenter Server®, a virtual appliance, provides a central management platform across ESXi™ hosts.
- Friendly UI: vSphere web client, a web management user interface, enables administrators to easily manage vCenter Server® or ESXi™ hosts.
- Easy VM migration: the function vMotion® in VMware vSphere enables VM migration between hosts which is vital for server redundancy.
- Auto resource balance: Distributed Resource Scheduler (DRS) can dynamically balance the shared computing resources for VMs within a cluster.
- Host redundancy: High availability (HA) function monitors hosts within a cluster to deal with the host failure. It migrates VMs to other available hosts when host failure occurs.
- Virtualized switch for VMs: Virtual Switch (VS) creates a virtualized network on each ESXi™ host and provides the network to each virtual machine. Virtual Distributed Switch (VDS), which is similar to virtual switch, further aggregates NICs, VMkernals, and portgroups together for a data center. The virtualized switch thus simplifies the management on a server network.

4.2.3. VMware vSAN™

vSAN™ is the software-defined storage which can be utilized to:

- aggregate storage devices of local hosts into a shared data store and provide access across hosts within the same cluster.

- provide the hyper-converged infrastructure with simple management and provisioning.
- provide vSAN™ storage policies to define availability factors such as failure to tolerate.
- integrate with vSphere hypervisor layer, which means 100% compatibility.
- enable high scalability that can be either scale-out or scale-up on demands quickly.

4.2.4. VMware Horizon®

VMware Horizon® is the key software of VDI with the combination of vSphere® and Horizon®. VDI brings an easy method to manage user desktop pools and apps environment with high security and efficient resource utilization. VMware Horizon® delivers a centralized virtual desktop management platform, different forms of virtual desktop deployment, a simple-updated desktop image for desktop groups, and simple security control of virtual desktops. Meanwhile, it effectively minimizes the management time and cost, and brings end users virtual desktops across devices and geo-locations with full utilization.

VMware Horizon® 7 Enterprise Edition is the version adopted in the solution. VMware Horizon® consists of several major components, as shown in Table 3 below.

Table 4. VMware Horizon® Software Features.

Name	Description
Horizon® Connection	A connection server acts as a bridge for client connections. The connection server authenticates users through Microsoft Active Directory and directs the request to the appropriate VM, physical or blade PC, or Windows Terminal Services server. The connection server provides management capabilities such as enabling SSO, authenticating client users, entitling client users to specific desktops or pools, and creating links between users and desktops. A connection server is used in the solution as the VDI management platform.
Horizon® Composer™	This software service manages VMs. Horizon® Composer™ can create a pool of linked clones from a specified parent VM. This strategy reduces storage cost up to 90 percent. Each linked clone acts like an independent desktop with a unique host name and IP address, yet the linked clone requires significantly less storage because it shares a base image with the parent. ITs can quickly deploy, update, and patch VM pools by updating only the parent virtual machine since the linked-clone desktop pools share a base image. A Composer™ is used in the solution to enable the linked-clone function.
Horizon® Client	This client software which accesses remote desktops and applications can run on a tablet, a phone, a notebook, etc. After logging in, users are authorized to use a list of remote desktops and apps. The permission process may require Active Directory credentials, a UPN, a smart card PIN, an RSA SecureID, or an authentication token. In the solution, View Clients are installed to log in to the virtual desktop services.
Active Directory	The Active Directory is developed from Microsoft for the Windows system domain networks. The Horizon® needs Active Directory infrastructure to perform user validation and management. One Active Directory server is used in the solution to manage the VDI topology.
Horizon® Agent	Acting as a bridge between Horizon® and VMs' guest OS, the Agent installed on the source parent VMs is used for the communication between client and virtual machines.

5. Solution Validation

The two tests are conducted to validate the solution- QxVDI-3D in the following aspects:

- The ability to establish a virtual desktop infrastructure and provide virtual GPU resource to each virtual desktop.
- The ability to execute 3D applications in VDI that QxVDI-3D provides.

5.1. Virtual Desktop Infrastructure (VDI) Test

5.1.1. Test Overview

The goal of this test is to validate the feasibility of QxVDI-3D, a hyper-converged infrastructure solution with GPU, to deliver a virtual desktop environment with virtualized GPU resource in each VM, and to provide smooth user experience. In this test, QCT used Login VSI testing tool and evaluated the score of VSIBase to validate the feasibility of the solution.

Login VSI is an industry-standard load-testing benchmark tool for centralizing virtualized desktop environment and is designed to perform benchmarks for SBC or VDI workloads. After the tests, Login VSI will generate VSIBase to evaluate the system performance. The lower the score is, the better the system performance will be. Login VSI defines reference rating in each VSIBase score ranges, as shown in Table 5.

Table 5. Login VSI Official Rating of Performance Score.

VSIBase score	Rating
0-799	Very Good
800-1199	Good
1200-1599	Fair
1600-1999	Poor
2000-9999	Very Poor

Table 6 is the workload profile officially defined by Login VSI. The workload, Power worker, is adopted in the test to simulate the realistic 3D VDI workload.

Table 6. Login VSI Official Workload Profiles.

Workload	App Executed	Approximate CPU Usage	Approximate IOPS per user	VM Memory	VM CPU
Task Worker	2-7	70%	6.0	1GB	1vCPU
Office Worker	5-8	82%	8.1	1.5GB	1vCPU
Knowledge Worker	5-9	100%	8.5	1.5GB	2vCPU
Power Worker	8-12	119%	10.8	2GB	2vCPU+

5.1.2. Test Configuration

The test configuration is same as the solution configuration mentioned in chapter 5. The test environment is deployed with vCenter server® VM, Connection server VM, Composer server VM, and Windows domain service VM in QxVDI-3D. Horizon® appliances and virtual desktops are installed on D52BV-2U servers while the Login VSI server and Login VSI launcher VMs are installed on Supporting Server, as shown in Figure 33.

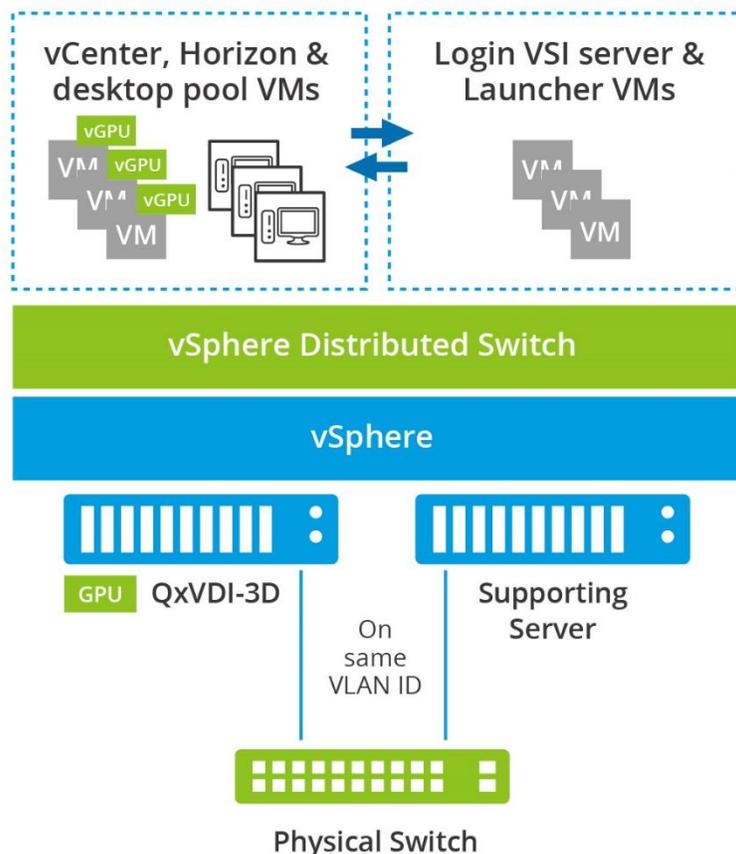


Figure 3. VDI Testing Topology.

The "Power Worker" workload is targeted in the solution test and the operating system - Windows 10 is chosen. The configuration of the virtual desktop profile is listed in Table 7.

Table 7. VM Profiles for VDI Test.

Test case #	Login VSI workload profile	OS	vGPU type	vCPU	vRAM (GB)	VM disk size	Total number of VM
1	Power Worker	Windows 10	P100-1Q	2	8	40GB	64

5.1.3. Test Result

The test result of Login VSI VSIBase scores is recorded in Table 8 and Fig. 12.

Table 8. Test Result of VDI Test.

Test case #	VSIBase	VSImax v4.1 threshold	VSImax v4.1 Average
1	768	1769	798

The test was executed successfully without any error. The VSIBase score 768 is under the “Very Good” Login VSI rating. The testing result reveals that the solution with specified hardware including GPU resource and VM profile can sustain the virtual desktop workloads and provide vGPU resources to each virtual desktop smoothly with no doubt.

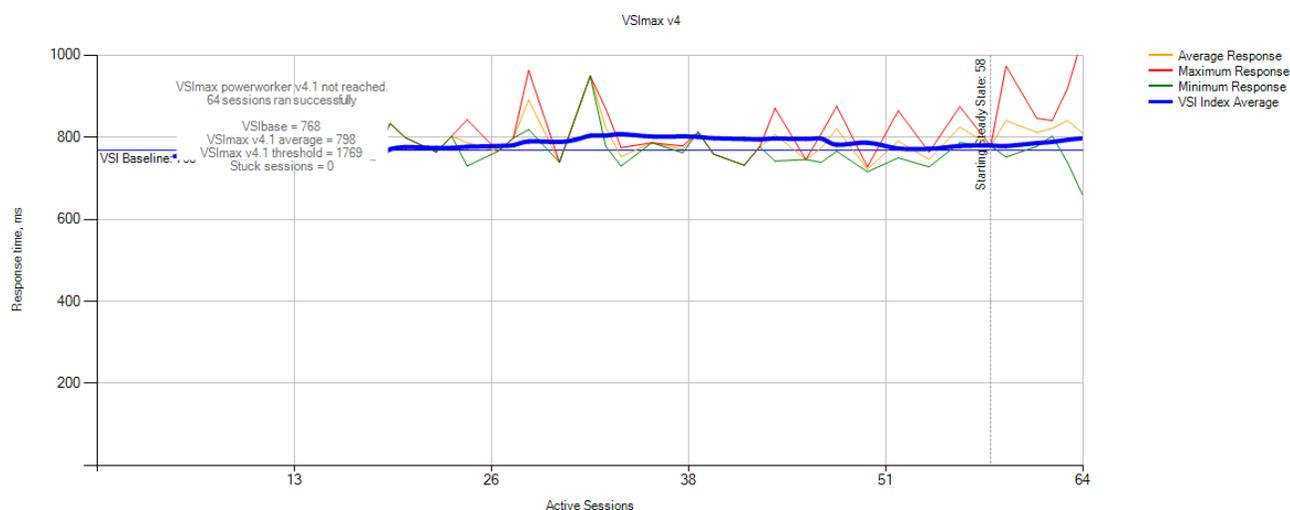


Figure 4. Test Result of VDI Test.

5.2. 3D Workload Validation Test

5.2.1. Test Overview

The goal of this test is to validate the capability of QxVDI-3D and to execute real 3D applications such as AutoCAD, Autodesk 3ds Max, PTC Creo, Autodesk Maya, and Autodesk Showcase in the VDI. The test is also to generate performance scores for customers’ reference. QCT used the benchmark tool, Cadalyst System Benchmark 2015 (C2015), to simulate a 3D application for different scenarios and evaluate the performance of the solution.

AutoCAD is a mainstream commercial computer-aided design (CAD) and a drafting software application developed by the company Autodesk. The Cadalyst Systems Benchmark 2015 (C2015) is a benchmark tool which can be adopted to test and compare the performance of the systems running AutoCAD versions 2000–2018. After the test, the benchmark tool generates four sub-index scores for different areas of performance including 3D Graphics Index, 2D Graphic Index, Disk Index, and CPU Index. The Total Index Score calculated based on these four sub-index scores indicates the difference between the test times of current system and a set of base times. For example, a total Index Score is 300, which means the test times of the test system is 300 times faster than base times.

Besides Cadalyst Systems Benchmark 2015, the benchmark tool- SPECviewperf® from the third party is also suggested to simulate 3D applications such as PTC Creo, Autodesk Maya, Autodesk Showcase, and Siemens NX.

5.2.2. Test Configuration

The test configuration is same as the solution configuration mentioned in chapter 5. The configuration of the virtual desktop profiles for the test is listed in Table 9.

Table 9. VM Profiles for 3D Workload Validation Test.

Test case #	Test case	Virtual GPU type	Total VM amount	vCPU	vRAM (GB)	VM disk size
2	16Q-4VM	P100-16Q	4	2	8	40GB
3	8Q-8VM	P100-8Q	8	2	8	40GB
4	4Q-16VM	P100-4Q	16	2	8	40GB
5	2Q-32VM	P100-2Q	32	2	8	40GB
6	1Q-64VM	P100-1Q	64	2	8	40GB

5.2.3. Test Result

The tests were executed successfully without any error. The reference performance is evaluated by the scores according to Cadalyst System Benchmark 2015, as shown in Table 10. The test results have proved that the capability of QxVDI-3D can support the 3D application running in virtual desktop environment with vGPU resources. Besides, the performance of the system is stable in supporting different number of VMs, which means QxVDI-3D can address diverse use cases.

Table 10. Test Results for 3D Workload Validation - Test Case 2-6.

Test Case #	C2015 Total Index	3D Graphics Index	2D Graphics Index	Disk Index	CPU Index
2	347	631	303	236	219
3	346	634	300	232	220
4	343	632	292	227	219
5	334	623	280	222	209
6	303	624	225	194	170

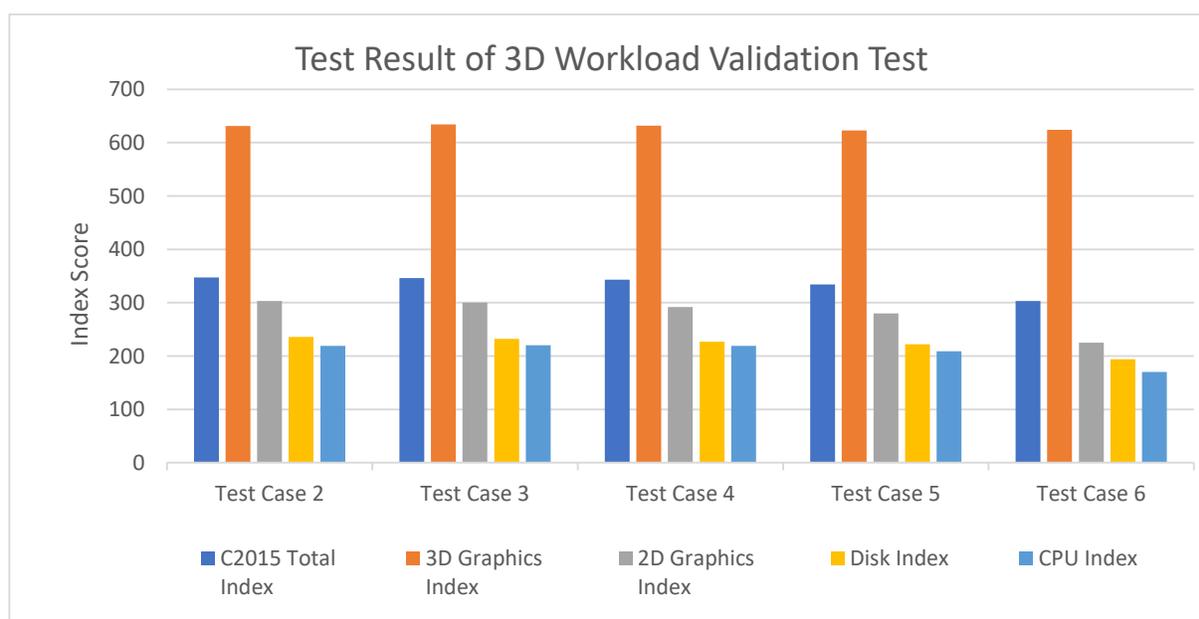


Figure 5. Test Result of 3D Workload Validation Test.

6. Conclusion

Nowadays, the operation of all organizations is digitalized and the ability to manage the digitalized information determines the future of an enterprise. QCT, a global data center solution provider, provides innovative and flexible solutions to keep your organizations in a leading position.

QxVDI-3D is a hyper-converged solution which can greatly simplify your system management and fulfill future scaling demand. In the solution, the server QuantaGrid D52BV-2U can apply at most four GPU cards and 24 DIMM slots in one server to provide sufficient performance in VDI and fulfill scale-up need in the future. With QxVDI-3D, customers can fully utilize GPU resources, enhance security, optimize user experience, and reduce CapEx and OpEx of an infrastructure.

According to the test results, the feasibility and stability of the solution are proven in both test cases. In the VDI test, the test results is under “Very Good” Login VSI rating which reveals that this solution can provide a stable virtual desktop environment with virtualized GPU resource. In the 3D application validation test, QxVDI-3D can smoothly run diverse 3D applications in virtual desktop environment and provide stable performance when different numbers of VMs are executed.

QxVDI-3D can successfully enable 3D applications running in virtual desktop environment. With the knowledge of QCT, customers can unleash their creativity and imagination in anywhere, anytime.

QCT always stays innovative. QCT appreciates any feedback from you. For further inquiry, please visit <http://go.qct.io/solutions/virtual-desktop-infrastructure/qxvdi-vmware-edition-3d/>

7. Reference

[1] Quanta Cloud Technology QuantaGrid D52BV-2U

<http://www.qct.io/product/index/Server/rackmount-server/GPGPU-Xeon-Phi/QuantaGrid-D52BV-2U>

[2] VMware vSphere®

<https://www.vmware.com/products/vsphere.html>

[3] VMware Horizon®

<https://www.vmware.com/products/horizon.html>

[4] VMware vSAN™

<https://www.vmware.com/products/vsan.html>

[5] Login VSI

<https://www.loginvsi.com>

[6] Cadalyt Systems Benchmark

<http://www.cadalyt.com/benchmark-test>

[7] NVIDIA

<http://www.nvidia.com>

LEGAL DISCLAIMER

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH QUANTA CLOUD TECHNOLOGY (QCT) PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN QCT'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, QCT ASSUMES NO LIABILITY WHATSOEVER AND QCT DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF QCT PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS OTHERWISE AGREED IN WRITING BY QCT, THE QCT PRODUCTS ARE NOT DESIGNED NOR INTENDED FOR ANY APPLICATION IN WHICH THE FAILURE OF THE QCT PRODUCT COULD CREATE A SITUATION WHERE PERSONAL INJURY OR DEATH MAY OCCUR.

Quanta Cloud Technology (QCT) may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." QCT reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

All products, computer systems, dates, and figures specified are preliminary based on current expectations, and are subject to change without notice. Contact your local QCT sales office or your distributor to obtain the latest specifications and before placing your product order.



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.



ABOUT QCT

QCT (Quanta Cloud Technology) is a global datacenter solution provider extending the power of hyperscale datacenter design in standard and open SKUs to all datacenter customers.

Product lines include servers, storage, network switches, integrated rack systems and cloud solutions, all delivering hyperscale efficiency, scalability, reliability, manageability, serviceability and optimized performance for each workload.

QCT offers a full spectrum of datacenter products and services from engineering, integration and optimization to global supply chain support, all under one roof.

The parent of QCT is Quanta Computer Inc., a Fortune Global 500 technology engineering and manufacturing company.

<http://www.QCT.io>



UNITED STATES

QCT LLC., Silicon Valley office
1010 Rincon Circle, San Jose, CA 95131
TOLL-FREE: 1-855-QCT-MUST
TEL: +1-510-270-6111
FAX: +1-510-270-6161
Support: +1-510-270-6216

QCT LLC., Seattle office

13810 SE Eastgate Way, Suite 190, Building 1,
Bellevue, WA 98005
TEL: +1-425-633-1620
FAX: +1-425-633-1621

CHINA

云达科技, 北京办公室 (Quanta Cloud Technology)
北京市朝阳区东大桥路 12 号润诚中心 2 号楼
TEL +86-10-5920-7600
FAX +86-10-5981-7958

云达科技, 杭州办公室 (Quanta Cloud Technology)
浙江省杭州市西湖区古墩路浙商财富中心 4 号楼 303 室
TEL +86-571-2819-8650

JAPAN

Quanta Cloud Technology Japan 株式会社
東京都港区芝大門 2-5-8 芝大門牧田ビル 3F, 105-0012
TEL +81-3-5777-0818
FAX +81-3-5777-0819

GERMANY

Quanta Cloud Technology Germany GmbH
Hamborner Str. 55, 40472 Düsseldorf
TEL +492405-4083-1

TAIWAN

雲達科技 (Quanta Cloud Technology)
桃園市龜山區文化二路 211 號 1 樓
1F, No. 211 Wenhua 2nd Rd., Guishan Dist., Taoyuan City 33377,
Taiwan

All specifications and figures are subject to change without prior notice. Actual products may look different from the photos.

QCT, the QCT logo, Rackgo, Quanta, and the Quanta logo are trademarks or registered trademarks of Quanta Computer Inc.

All trademarks and logos are the properties of their representative holders.

Copyright © 2017-2018 Quanta Computer Inc. All rights reserved.