

Getting Started with HDX 3D Pro



Reviewer's Guide for Remote 3D Graphics Apps

Part 2: vSphere GPU Pass-through

with XenDesktop 7 Apps, Nvidia GRID K1/K2 cards, Dell R720 Server

CITRIX.



Getting Started with HDX 3D Pro

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Audience

In the <u>first part</u> of this guide, we saw how to physically install Nvidia GRID cards with graphics processing units (GPU) in compatible server hardware. Part 1 also discusses how to enable GPU pass-through in XenServer and test that it is working in the VM. In this part, we list the steps necessary to enable shared GPU acceleration for 3D applications using Citrix XenDesktop 7 Apps on VMware vSphere. VMware calls this virtual Dedicated Graphics Acceleration (vDGA).

This guide walks through the following topics:

- Configuration of GPU acceleration on the hypervisors vSphere 5.1
- Install, configure and assign GPU to a XenDesktop 7 WIndows Server VM
- Verify 3D applications are using the GPU
- Install and publish 3D applications and hosted shared desktop(s) using Desktop Studio
- Access 3D applications from Citrix Receiver on any device

It is assumed that the reader has good knowledge of networking, virtualization, server hardware, and Windows administration. Familiarity with Citrix and Nvidia products is recommended but not essential to complete these steps. Please see the resources section for more information.

Related Documents in this Series

Part 1: XenServer GPU pass-through for Citrix XenDesktop 7 (includes, physical installation of GPU cards)

Part 2: vSphere GPU pass-through (a.k.a vDGA) for Citrix XenDesktop 7

Part 3: XenServer GPU virtualization (a.k.a vGPU) for Citrix XenDesktop 7

Part 4: vSphere shared GPU (a.k.a vSGA) for Citrix XenDesktop 7

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Lab Environment

Hardware	
Graphical Processing Unit (GPU)	NVIDIA GRID K1 (K1 and K2 Specs)
Server hardware	Dell R720 (PowerEdge R720 Technical Guide)
GPU Installation Kit	 Power Cables (2 – Internal for GPU)
	Heat Sink
Storage	Local/ NFS

Software	
Hypervisor(s)	VMware ESXi 5.1.0 build 838463
	XenServer 6.2.0-rc4 build 69934c
NVIDIA GPU driver	<u>320.00</u> (GRID K1)
Guest OS	Windows Server 2008 R2 Standard Service Pack 1
	Windows 7 Service Pack 1

Go to *Control Panel* \rightarrow *Add/Remove Programs* and ensure the following components are updated on your target virtual machine before you begin the 3D optimization process.

Tools and Applications				
Hypervisor Tools (latest)	VMware Tools			
	XenServer Tools			
Windows Applications	Adobe Flash Player			
	Adobe Reader			
	Java Plugin			
	Microsoft .NET Framework 4 (latest)			
GPU statistics (free third-party utilities)	TechPowerUp GPU-Z			
	OpenGL Viewer			

The process for enabling 3D acceleration for shared user-sessions is quite similar with certain customizations for each hypervisor. Figure 1 and Figure 2 shows the difference between Citrix and VMware implementation of GPU pass-through.



r						
	Legend					
1	Operating system	Windows Server is a multi-user OS, while Windows Desktop is a single-user OS				
	(OS) type					
2	User-sessions	Each application is running in its own user-session, within the same OS instance				
3	Delivery Agent	The Citrix software that enables connections between end-users and the published				
		applications				
4	Hypervisor	This is the platform to virtualize the applications, and enable sharing of resources such as GPU				
5	GPU card	GRID architecture is the next-generation hardware from Nvidia that supports multiple GPU				
		cards on a single board, and has been designed to work with virtualized workloads.				
6	Graphics driver	Renders the graphics commands from the 3D applications to the display.				
7	Graphics	In the case of GPU-pass-through or vDGA, the virtual machine has direct and full access to the				
	Virtualization type	underlying GPU hardware.				

VMware: Virtual Dedicated Graphics Acceleration (vDGA)

Source: VMware Horizon View Graphics Acceleration Deployment Guide [PDF]

As seen in Figure 2 above, enabling vDGA on VMware vSphere allows VM full and direct access to the underlying GPU hardware. We will enable vDGA (also called GPU pass-through) for a Windows Server virtual machine that will host the 3D applications to be delivered using XenDesktop 7.

To configure an ESXi host with only a single GPU, first find the PCI ID of the graphics device by running the following command:

```
~ # lspci | grep -i display
00:07:00.0 Display controller: nVidia Corporation GK107 [VGX K1]
00:08:00.0 Display controller: nVidia Corporation GK107 [VGX K1]
00:09:00.0 Display controller: nVidia Corporation GK107 [VGX K1]
00:0a:00.0 Display controller: nVidia Corporation GK107 [VGX K1]
00:10:00.0 Display controller: Matrox Electronics Systems Ltd. G200eR2
~ #
```

00:07:00.0 is the PCI ID of the graphics card.

Confirm Successful Installation

To check if the Graphics Adapter has been installed correctly, run the following command on the ESXi host. In case of GRID K1, it shows the 4 GPU cards available on the single board ~ # esxcli hardware pci list -c 0x0300 -m 0xff

See the Appendix for detailed command output.

VMware vSphere vDGA Configuration

This section takes you through enabling GPU pass-through at the host level and preparing the virtual machines for 3D rendering.

Enable the Host for GPU Pass-through

To enable an ESXi host for GPU pass-through, follow the documented checks and steps in the following section.

(Optional Step) Check VT-d or AMD IOMMU Is Enabled

[Note: This step is only required when the server hardware is new and hypervisor is not yet installed.]

Before pass-through can be enabled, check if VT-d or AMD IOMMU is enabled on the host by running the following command, either via SSH or on the console. (Note: replace <module_name> with the name of the module: vtddmar for Intel, AMDiommu for AMD).

```
# esxcfg-module -1 | grep <module_name>
```

If above does not give any output, then browse to the below location to verify either vtddmar or AMDiommu is listed depending on your server hardware.

/usr/lib/vmware/vmkmod # lsfiledrivermegaraid_mboxAMDIommufiledrivermegaraid_mboxaacraidfnicmegaraid_sasadp94xxforcedethmigrateahcihbr_filtermpt2sas

If the appropriate module is not present, you might have to enable it in the BIOS, or your hardware might not be capable of providing PCI passthrough.



Enable Device Pass-through

Using the vSphere Client, connect to VMware vCenter and select the host with the GPU card installed.



🚰 Mark devices for passthrough	x	In the Mark Devices
Mark devices for passthrough:	de Details	for Passthrough
01:00.0 Broadcom Corporation NetXtreme BCM5720 Gigabit Ethern	et [vmr 🔺	window, check the
01:00.1 Broadcom Corporation NetXtreme BCM5720 Gigabit Etherne	et	box that corresponds
O::01.0 Intel Corporation Xeon E5/Core i7 IIO PCI Express Root Port 1a		to the GPU adapter
Image: Second Second Corporation NetXtreme BCM5720 Gigabit Etherne Image: Second Sec		installed in the host.
Composition Xeon E5/Core i7 IIO PCI Express Root Port 20		
03:00.0 LSI / Symbios Logic Dell PERC H710 Mini [vmhba1]		You'll receive a
Image: Corporation Xeon E5/Core i7 IIO PCI Express Root Port 3	a in PCI	Warning:
E III IIII 06:08.0 Unknown PCI/PCI bridge		The device has a
07:00.0 NVIDIA Corporation GK107 [VGX K1]		denendent device The
🖻 – 🛄 💹 06:09.0 Unknown PCI/PCI bridge		dependent device. The
Mark device as passtbrough	X	also he marked as
		nassthrough enghled
 This device bas a dependent device. The dependent device will 		automaticallul
also be marked as passthrough enabled automatically!		automaticany:
		You may ignore the
	- L - L	you may ignore the
Devic		
1 This device is passthrough capable but not running in passthrough mode		
Device Name C600/X79 series ch Vendor Name Intel Corpor-	ation	
ID 00:1a.0 Class ID C03		In the Mark Devices
Mark devices for passthrough: Hide Details		for Passtbrough
02:00.0 Broadcom Corporation NetXtreme BCM5720 Gigabit Ethernet		window check the
DIM 02:00.1 Broadcom Corporation NetXtreme BCM5720 Gigabit Ethernet		how that corresponds
O3:00.0 LSI / Symbios Logic Dell PERC H710 Mini [vmhba1]		to the CDU adapter
O0:03.0 Intel Corporation Xeon E5/Core i7 IIO PCI Express Root Port 3a in PCI		in the GPU duapter
C:URI 06:08.0 Unknown PCI/PCI bridge		installed in the nost.
07:00.0 NVIDIA Corporation GK107 [VGX K1]		
CONTRACTOR OF CONTRACTOR		
⊡		
Oa:00.0 NVIDIA Corporation GK107 [VGX K1]		
ia		
⊡ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □		
III III IIII IIII IIII IIIIIII IIIIIIII		
Device Details		
This device is passthrough capable but not running in passthrough mode		

Each listed device is a	available for direct access by the virtual mach	nines on this host.		Hide Details Refr	esh Edit	The GPU should now be listed in the
	VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1]					Window on the Advanced Settings
Device Details						page.
🐻 This device is n	unning in passthrough mode					
Device Name	GK107 [VGX K1]	Vendor Name	NVIDIA Corporation			
ID	07:00.0	Class ID	300			
Device ID	FF2	Subdevice ID	99D			
Vendor ID	10DE	Subvendor ID	10DE			
Function	0	Slot	0			
Bus	7					
Each listed device is a	vailable for direct access by the virtual mach	ines on this host.				If the device icon is
				Hide Details Refre	esh Edit	green, passthrough is
	VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1]					enabled.
Device Details						
🐻 This device is n	unning in passthrough mode					
Device Name	GK107 [VGX K1]	Vendor Name	NVIDIA Corporation			
ID	07:00.0	Class ID	300			
Device ID	FF2	Subdevice ID	99D			
Vendor ID	10DE	Subvendor ID	10DE			
Function	0	Slot	0			
Bus	7					
Each listed device is a	available for direct access by the virtual mach	ines on this host.				If the device has an
🔶 Changes made t	to some of the devices below will not take eff	ect until the host is restarted.				orange arrow
				Hide Details Refre	sh Edit	displayed on the icon
07:00.0 N' 08:00.0 N' 09:00.0 N' 09:00.0 N' 0a:00.0 N'	VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1] VIDIA Corporation GK107 [VGX K1]					the host needs to be rebooted before
Device Details						
🐺 This device nee	eds host reboot to start running in passthrou	gh mode				function.
Device Name	GK107 [VGX K1]	Vendor Name	NVIDIA Corporation			
ID	07:00.0	Class ID	300			
Device ID	FF2	Subdevice ID	99D			
Vendor ID	10DE	Subvendor ID	10DE			
Function	0	Slot	0			
Bus	7					

Enable the Virtual Machine for GPU Pass-through

To enable a virtual machine for GPU pass-through, follow the documented checks and steps in the following section.

Update to Hardware Version 9

You must upgrade all 3D virtual machines to Hardware version 9 (HWv9 shows as *vmx-09*) to ensure maximum compatibility.

🛃 w7vsi - Virtual Machine Properties		Pre Virtual Hardware upgrade:
Hardware Options Resources Profiles VServices	Virtual Machine Version: 8	Virtual Machine Version is 9
	Memory Configuration	virtual Machine Version is 8
Show All Devices Add Remove	1011 GB	
Hardware Summary		
Memory 2048 MB	Maximum recommended for this	

win win 10.105. repl viev	Power Guest Snapshot Open Console Edit Settings	-	From vCenter: →Right-click the virtual machine to be upgraded →Select Upgrade Virtual Hardware
viev viev viev win XDv	Migrate Upgrade Virtual Hardware Clone Template		
Confirm Virtue	al Machine Upgrade s operation will cause the virtual hardware your guest rating system runs on to change. It is an irreversible op t will make your virtual machine incompabible with earlier sions of VMware software products. It is strongly ommended that you make a backup copy of your disks t ceeding. e you sure you want to upgrade your configuration? Yes	veration before	Upgrade Warning The virtual hardware version upgrade is an irreversible process. You may ignore this message.
Hardware C	- Virtual Machine Properties Dptions Resources Profiles VServices All Devices Add Ren Summary	Virtual Machine Version: vmx-09 Memory Configuration 1011 GB 1011 GB 102	Post Virtual Hardware upgrade: Virtual Machine Version is <i>vmx</i> - 09

Reserve All Configured Memory

For vDGA to function, all the virtual machine configured memory must be reserved. If each virtual machine has 2GB of memory allocated, you should reserve all 2GB. To do this:

🚱 XDW2K8 - Virtual Machin	ne Properties				Select the Reserve all guest
Hardware Options Resource	es Profiles VServices		Virtual Machine Ve	rsion: vmx-09	memory ontion when you
Settings	Summary	-Resource Alloc	ation		memory option when you
CPU	0 MHz				view the Memory option
Memory	12288 MB (All lock	Reserve al	l guest memory (All locked))		under the Resources tab in a
Disk	Normal				
Advanced CPU	HT Sharing: Any	Shares:	Normal 1228	80 🖃	virtual machine's settings
Advanced Memory	NUMA Nodes: 2	Reservation:		88 🚍 MB	window.
		Limit:	Unlimited	95 💉 MB	By default, memory of VMs are unreserved i.e. Reserver all guest memory check-box is
		▲ Limit based or	parent resource pool or current host		unchecked.

Adjust pciHole.start

Note: This is required only if the virtual machine has more than 2GB of configured memory. Before you start, ensure that the virtual machine is shut down completely.



Add the PCI Device

To enable vDGA for a virtual machine, the PCI device needs to be added to the virtual machine's hardware. Using the vSphere Client, connect directly to the ESXi host with the GPU card installed, or select the host in vCenter.



🛃 Add Hardware	X	Salact and of the CBUIs from
Choose PCI Device Which of the present PCI/F	CIe devices would you like to add?	the GRID as the passthrough device to connect to the virtual
Device Type Select PCI/PCIe Device Ready to Complete	Connection	machine from the drop-down list, and click Next .
	07:00.0 NVIDIA Corporation GK107 [VGX K1]	
	Note: The presence of a PCI/PCIe device passthrough will prevent the use of many commands on the virtual machine. It will not be able to be suspended, to have snapshots taken or restored, or to participate in vMotion. Adding a PCI Passthrough device to this VM will automatically set its minimum memory reservation equal to its memory size.	All the four GPUs in the GRID are listed under PCIe device connection list
Help	<pre></pre>	
🛃 Add Hardware		
Choose PCI Device Which of the present PCI	/PCIe devices would you like to add?	
Device Type	Connection	
Select PCI/PCIe Device Ready to Complete	Specify the physical PCI/PCIe Device to connect to:	
	07:00.0 NVIDIA Corporation GK107 [VGX K1]	
	07:00.0 NVIDIA Corporation GK107 [VGX K1] 08:00.0 NVIDIA Corporation GK107 [VGX K1]	
	09:00.0 NVIDIA Corporation GK107 [VGX K1] Oa:00.0 NVIDIA Corporation GK107 [VGX K1]	
	or restored, or to participate in vMotion.	
Ready to Complete	A	Click Finish
Review the selected option	is and click Finish to add the hardware.	
Device Type Select PCI/PCIe Device	Options:	
Ready to Complete	Hardware type: PCI Device PCI/PCIe Device: 07:00.0 NVIDIA Corporation GK107 [VGX K1]	
<u> </u>		
Help	< Back Finish Cancel	

🛃 XDW2K81 - Virtual Machine Properties		Click OK
Hardware Options Resources Profiles vServices	Virtual Machine Version: vmx-09	
Show All Devices Add Remove	Connection Specify the physical PCT/PCTe Device to connect to:	
Hardware Summary		
Memory 12288 MB	07:00.0 NVIDIA Corporation GK107 [VGX K1]	
CPUs 2		
📃 Video card Video card	Note: the presence of a DCI/DCIe deuise pacethrough	
UMCI device Restricted	will prevent many commands on the virtual machine. It	
SCSI controller 0 LSI Logic SAS	will not be able to be suspended, to have snapshots	
😅 Hard disk 1 Virtual Disk	taken or restored, or to participate in viviotion.	
CD/DVD drive 1 Client Device		
Network adapter 1 VM Network		
NVIDIA Corporation		
нер	OK Cancel	

Install the NVIDIA Driver

Two ways to install NVIDIA driver on the guest OS (Desktop VDA and/or XenApp server):

• **Microsoft Windows Update**: Run windows update and NVIDIA driver will be available for download under **Optional** updates.

<u>@</u> s	elect updat	to install			Microsoft Windows Undate
G)⊙∘ 🖉	Control Panel System and Security Windows Update Select updates to install	👻 🔯 Search Control Panel 🛃	Where some windows opuate	
9	select the u	dates you want to install			
		🖌 Name 🔺		nVidia - Graphics Adapter WDDM1.1, Graphics	
In	portant (2)	Windows Server 2008 R2 (4)	Ξ	Adapter WDDM1.2, Other hardware - NVIDIA Quadro 4000	
Op	tional (4)	🗹 nVidia - Graphics Adapter WDDM1.1, Graphics Adapter WDDM1.2, Other hardware - NVIDIA Quadro 4000	228.5 MB	🔆 Recommended Update	
		Update for Best Practices Analyzer for Application Server for Windows Server 2008 R2 x64 Edition (KB2386667)	105 KB	~	
		Update for Windows Server 2008 R2 x64 Edition (KB2529073)	381 KB	nVidia Graphics Adapter WDDM1.1, Graphics Adapter WDDM1.2. Other bardware software update released in	
		Update for Windows Server 2008 R2 x64 Edition (KB982018)	4.1 MB	February, 2013	
				Published: 3/16/2013	
				You may need to restart your computer after installing this update.	
				Update is ready for downloading	
				More information	
				Support information	

• **NVIDIA website**: Download and install the latest NVIDIA Windows driver on the virtual machine. All NVID IA drivers can be downloaded from the NVIDIA Download Drivers page.

NVIDIA Home > Download Drivers	NVIDIA Driver Downloads		NVIDIA website
HIGH-PERFORMANCE GAMING MEETS PORTABLE ENTERTAINMENT	Option 1: Manually find drivers for my NVIDIA products. Product Type: GeForce Product Series: GeForce 700 Series Product: GeForce GTX TITAN Operating System: Windows 7 64-bit Language: English (US)	Hep	Select Option 2 Click Graphics Drivers button
Annuary SPLATER: DELL ELADALIST	Option 2: Automatically find drivers for my NVIDIA products.	Leam More GRAPHICS DRIVERS MOTHERBOARDS DRIVERS	

NVIDIA Driver Downloads			Pre-requisite to scan : Latest Java
Product Current Installed Driver GRID K1	Recommended Update Quadro/NV5/Tesla/GRID Desktop Driver Release Version: 320.49 WHQL Release Date: 3.7.2013 Leam More	BR319 DOWNLOAD	update The nvidia.com website scans automatically and shows the appropriate latest driver to download Direct download for GRID K1 URL: http://www.nvidia.com/object/quadro tesla-grid-win8-win7-winvista-64bit- 320.49-whol-driver.html [189 MB]
Display adapters Standard VGA Graphics Ad VMware SVGA 3D Display adapters NVIDIA GRID K1 VMware SVCA 3D	dapter		Before: Display adapter has warning before NVIDIA guest OS driver is installed <u>After:</u> Display adapter with NO warning after NVIDIA guest OS driver is installed
Image: VMWare SVGA 3D Image: TechPowerUp GPU-2 0.7.2 Graphics Card Sensors Validation Name NVIDIA GRID GPU GK107 Revision GPU GK107 Revision Technology 28 nm Die Size Release Date Mar 18, 2013 Transiston BIOS Version 80.07.4E.00.00 Device ID 10DE - 0FF2 Subvence ROPs/TMUs 16 / 16 Bus Interfa Shaders 192 Unified Di Pixel Fillrate 13.6 GPixel/s Text Memory Type DDR3 Memory GPU Clock 850 MHz Memory 8 Driver Version nvlddmkm 9.18.13.2049 GPU Clock 850 MHz Memory 8 NVIDIA SLI Di Di Computing OpenCL CUDA T NVIDIA GRID K1 Text Text Text Text Text	K1 an A2 ze 118 mm² rs 1300M 5 (P2401-0500) dor NVIDIA (10DE) ce PCI-E 2.0 x32 @ x32 2.0 ? rectX Support 11.0 / SM5.0 ure Fillrate 13.6 GTexel/s Bus Width 128 Bit Bandwidth 28.5 GB/s (ForceWare 320.49) / 2008 R2 91 MHz Shader N/A 91 MHz Shader N/A 91 MHz Shader N/A 91 MHz Shader N/A		GPU-Z shows NVIDIA GRID K1 running o the VM

After the driver is installed, reboot the virtual machine.

XenServer GPU-Passthrough

Please see the **Part 1 of this guide** for step-by-step instructions on enabling GPU pass-through on Citrix XenServer.

Installation of XenDesktop 7 and Delivering 3D Apps from Windows Server OS

- Install Virtual Desktop Agent (VDA) on the guest OS. For publishing hosted applications and shared desktops, install VDA on Windows Server 2008 R2 or Server 2012.
- Please see the <u>Reviewer's Guide</u> for step-by-step instructions on installing the virtual desktop agent and other Citrix XenDesktop components such as the Studio.

End-user Experience from Citrix Receiver

This section shows the users launching 3D applications published with XenDesktop 7 Apps (formerly, XenApp) using Citrix Receiver on the end-point devices. In this example, we launch multiple sessions of Unigine Heaven 3D and Google Earth, freely available demo apps, from XenDesktop server hosted on both VMware vSphere and Citrix XenServer (with GPU enabled, as seen previously).

3D Application	Unigine Heaven, Google Earth, eDrawings			
Monitoring Tools used	 Process Explorer with GPU monitoring enabled 			
	o GPU-Z			
	o Furmark			
	o GPU Shark			
No. of XenApp sessions (users) tested	2 and 4			
GPU Card	GRID K1			

Launch desktops and applications on Windows client

Citrix Receiver is the unified access client to access applications and desktops from StoreFront. With a user account, you will access those applications and desktops.







This screenshot shows 4 3D user-sessions sharing single GPU @ ~52-55% GPU Load

System Informa	ation				- 🗆 🗙 Gee	ks3D FurMark 1.11.0	GPU Shark v0.7.3	
Summary CPU GPU Usage	Memory I/O GPU	1				FUR	File Wew Tools Help Links GPU 1 - GRID K1 - GPU: unknown - Bus ID: 19 - Deside: ID: 10DE-EE2	
25.63% GPU Dedicated	Memory			^ ^{perce}		GPUS OpenG (C)2007 etected GPUs: GPU 1: GRID K1, GPU: 46*C	 - Device 10: INUDE-FFC - Subvendor: NVIDA (10DE- 99D) - Driver version: - NV driver branch: - OS: Windows Server 2008 R2 64-bi - Bios version: 80.07.4e.00.06 - GPU memory size: 4MB - Bus width: 128-bit 	t
2.0 GB						_	- GPU memory location: GPU dedicat	ted
GPU System Me	emory						- GPU temp: 46.0°C (min:34.0°C - ma: - Fan speed: 34.0% - GPU cores: 192 - True current clock speeds / VDDC: - Core: 849.0MHz	<:47.0°(
56.3 MB					_		- Mem: 891.0MHz	
Dedicated GPU Current Limit View individual	V Memory (K) 2,118,368 4,141,888 GPU engine usage and sele FPS: 4 tings	m GPU Memory (K) ent 57,688 3,862,072 ct engines used for GPU usage co ct angles used for GPU usage co Quality Sound FPS	alculations: Engines		OK		- GTX 600+ monitoring: - Clock speeds offsets: - GPU core: 0.0MHz - GPU voltage: 0.000V - Mem: 0.0MHz - GPU power: - Current power: 23.8% TDP - Min power: 72.3% TDP - Max power: 106.4% TDP	
- M	GRID K1	GRID	HI	Memory Usage (Dedicated)	2068 MB		- Default power: 100.0% TDP	
Ter	mperature: 46 °C	Temperature: 46	"C	Memory Usage (Dynamic) 🔫	53 MB		- GPU and memory usage:	
	11.2.3			Power Consumption *	19.6 % TDP		- GPU: 82.0%, max: 99.0% - GPU memory: 52.0%	
	Juality	Sound PPSuk	×	VDDC -	1.0120 V		- GPU memory controller: 33.0%	
	S.	GRID K1 Marnory: 891 MHz Famberature: 46 °C	Sound FPS/UP GRID K1 Mamory: 891 MHz Temperature: 4810	□ Log to file □ Continue refreshing this scr	en while GPU-Z is	in the background	- no limitation - Current active 3D applications: — heaven.exe [PID: 5500] — heaven.exe [PID: 1844]	
				LEADLE COLD KI		I	(DID: 2000)	

Summary

In this first part of the HDX 3D Pro Reviewer's Guide, we learnt how to identify the different hardware components of HDX 3D Pro solution and complete the physical installation. We also saw how to enable GPU pass-through on XenServer. In this document, we configured GPU pass-through on VMware's vSphere hypervisor, and tested the GPU being ready for use inside the virtual machine (VM). Using a Windows Server VM, this GPU can be shared by multiple users through XenDesktop 7 Apps. Please refer to the XenDesktop 7 Reviewer's Guide to learn how these VMs act as the base image for HDX 3D delivery using Citrix XenDesktop. It explains the steps for setting up the XenDesktop infrastructure and accessing applications from thin-clients and standard PCs using Citrix Receiver.

In the next two parts, we learn the steps to enable shared GPU access for desktops using the hardware virtualization technology in <u>XenServer</u> (vGPU) and software implementation in <u>vSphere</u> (vSGA).

Appendix

Third-party 3D applications and GPU benchmark tools and blogs

[Note: These are utilities found on the Internet and not provided by Citrix. Citrix does not guarantee or support use of these tools.]

Third-party tools	URLs
3DMark	http://www.3dmark.com/
	Download: location1 or location2
Geeks3D	http://www.geeks3d.com/
	http://www.geeks3d.com/20130719/furmark-1-11-0-gpu-
	vga-videocard-burn-in-stress-test-opengl-benchmark-
	utility-nvidia-geforce-amd-radeon/
	http://www.geeks3d.com/20110408/download-tessmark-
	0-3-0-released/
	http://www.geeks3d.com/20130308/fluidmark-1-5-1-
	physx-benchmark-fluid-sph-simulation-opengl-download/
	http://www.geeks3d.com/20120511/geexlab-0-4-0-
	ultim8-edition-available-gtx-600-opengl-bindless-textures-
	support-added/
	http://www.geeks3d.com/20110719/quick-test-process-
	explorer-15-0-with-gpu-support/
Aquamark	http://downloads.guru3d.com/download.php?det=673
3dmark	http://www.futuremark.com/benchmarks/
Lightsmark	http://dee.cz/lightsmark/
Furmark	http://www.ozone3d.net/benchmarks/fur/
	GPU Shark: http://www.ozone3d.net/gpushark/
	GPU –Z: http://www.techpowerup.com/gpuz

Demo Apps	
Unigine	http://unigine.com/products/heaven/download/
Google Earth	http://www.google.com/earth
eDrawings	http://www.edrawingsviewer.com/ed/edrawings-
	<u>samples.htm</u>
Adobe Photoshop (trial)	http://www.adobe.com/photoshop
Autodesk Inventor	http://www.autodesk.com/inventor

Command to check if GPU is installed properly

To check if the Graphics Adapter has been installed correctly, run the following command on the ESXi host. In case of GRID K1, it shows the 4 GPU cards available on the single board: ~ # esxcli hardware pci list -c 0x0300 -m 0xff 000:007:00.0 Address: 000:007:00.0 Segment: 0x0000 Bus: 0x07 Slot: 0x00 Function: 0x00 VMkernel Name: Vendor Name: NVIDIA Corporation Device Name: GK107 [VGX K1] Configured Owner: Unknown Current Owner: VMkernel Vendor ID: 0x10de Device ID: 0x0ff2 SubVendor ID: 0x10de SubDevice ID: 0x099d Device Class: 0x0300 Device Class Name: VGA compatible controller Programming Interface: 0x00 Revision ID: 0xal Interrupt Line: 0x0f IRQ: 15 Interrupt Vector: 0xc0 PCI Pin: 0xc0 Spawned Bus: 0x00 Flags: 0x0201 Module ID: -1 Module Name: None Chassis: 0 Physical Slot: 8 Slot Description: Passthru Capable: true Parent Device: PCI 0:6:8:0 Dependent Device: PCI 0:6:8:0 Reset Method: Bridge reset FPT Sharable: true 000:008:00.0 Address: 000:008:00.0 Segment: 0x0000 Bus: 0x08 Slot: 0x00 Function: 0x00 VMkernel Name: Vendor Name: NVIDIA Corporation Device Name: GK107 [VGX K1] Configured Owner: Unknown Current Owner: VMkernel

Vendor ID: 0x10de Device ID: 0x0ff2 SubVendor ID: 0x10de SubDevice ID: 0x099d Device Class: 0x0300 Device Class Name: VGA compatible controller Programming Interface: 0x00 Revision ID: 0xal Interrupt Line: 0x0e IRQ: 14 Interrupt Vector: 0xc8 PCI Pin: 0xc8 Spawned Bus: 0x00 Flags: 0x0201 Module ID: -1 Module Name: None Chassis: 0 Physical Slot: 9 Slot Description: Passthru Capable: true Parent Device: PCI 0:6:9:0 Dependent Device: PCI 0:6:9:0 Reset Method: Bridge reset FPT Sharable: true 000:009:00.0 Address: 000:009:00.0 Segment: 0x0000 Bus: 0x09 Slot: 0x00 Function: 0x00 VMkernel Name: Vendor Name: NVIDIA Corporation Device Name: GK107 [VGX K1] Configured Owner: Unknown Current Owner: VMkernel Vendor ID: 0x10de Device ID: 0x0ff2 SubVendor ID: 0x10de SubDevice ID: 0x099d Device Class: 0x0300 Device Class Name: VGA compatible controller Programming Interface: 0x00 Revision ID: 0xal Interrupt Line: 0x0f IRQ: 15 Interrupt Vector: 0xc0 PCI Pin: 0x63 Spawned Bus: 0x00 Flags: 0x0201 Module ID: -1 Module Name: None

Chassis: 0 Physical Slot: 16 Slot Description: Passthru Capable: true Parent Device: PCI 0:6:16:0 Dependent Device: PCI 0:6:16:0 Reset Method: Bridge reset FPT Sharable: true 000:00a:00.0 Address: 000:00a:00.0 Segment: 0x0000 Bus: OxOa Slot: 0x00 Function: 0x00 VMkernel Name: Vendor Name: NVIDIA Corporation Device Name: GK107 [VGX K1] Configured Owner: Unknown Current Owner: VMkernel Vendor ID: 0x10de Device ID: 0x0ff2 SubVendor ID: 0x10de SubDevice ID: 0x099d Device Class: 0x0300 Device Class Name: VGA compatible controller Programming Interface: 0x00 Revision ID: 0xal Interrupt Line: 0x0e IRQ: 14 Interrupt Vector: 0xc8 PCI Pin: 0x00 Spawned Bus: 0x00 Flags: 0x0201 Module ID: -1 Module Name: None Chassis: 0 Physical Slot: 17 Slot Description: Passthru Capable: true Parent Device: PCI 0:6:17:0 Dependent Device: PCI 0:6:17:0 Reset Method: Bridge reset FPT Sharable: true

~ #

If the NVIDIA GPU is not listed in the above output, then GPU card is either not installed correctly and/or is malfunctioning. Also, ensure the Xorg service is up and running.

Related Documents in this Series

Part 1: XenServer GPU pass-through for Citrix XenDesktop 7 (includes, physical installation of GPU cards)

Part 2: vSphere GPU pass-through (a.k.a vDGA) for Citrix XenDesktop 7

Part 3: XenServer GPU virtualization (a.k.a vGPU) for Citrix XenDesktop 7

Part 4: vSphere shared GPU (a.k.a vSGA) for Citrix XenDesktop 7