# S9299 NVIDIA VGPU ON RED HAT LINUX HYPERVISOR (RHV)



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### AGENDA

- What We Will Discuss
- Benefits of Virtualization
- Why RHV and vGPU?
- Target Audience and Prerequisites
- Design & Implementation
- Demonstration
- Summary

#### WHAT WE WILL DISCUSS

A practical approach to design and implement NVIDIA Virtual GPU on Red Hat Hypervisor in an enterprise IT environment

...and why you would want to do it!

#### BENEFITS OF VIRTUAL DESKTOP INFRASTRUCTURE

- Enable flexible workflow scenarios
- Utilize centralized, shared, and protected storage
- Enable intellectual property protection
- Provide flexibility in configuration
- Enable user/workforce mobility
- Widely supported GPU acceleration

What you planned the system to do.

### **NVIDIA VGPU SOLUTION**

Industry Standard Graphics Virtualization Platform

Support, Updates & Maintenance



### HOW DOES NVIDIA vGPU WORK?



Hardware

# WHY RED HAT VIRTUALIZATION?



Maximizes physical infrastructure utilization while reducing costs

- RHEL is the leading Linux distro for enterprises
- Supports both graphics and compute workloads in both Linux and Windows
- Utilize one GPU across several virtual technical workstations using mediated device support
- Support for multi-vGPU implementations

#### Automation and Seamless Deployments

- Centralized management in a data center deployment
- Customer can re-use many RHEL 7 security practices for their RHV infrastructure
- Tighter integration with the Red Hat portfolio via consistent API's vs competitors portfolio and disparate proprietary plugins

#### Wide Customer Adoption

• Oil & Gas, Energy, Animation, Manufacturing and Gaming

#### **REFERENCE ARCHITECTURE**



### **BEFORE YOU START**

- Target Audience
  - □ Linux System Administrators
  - □ Infrastructure Architects
- Hardware Requirements

□ Supported Server OEM Platform

□ Supported NVIDIA Data Center GPU (no K1/K2)

• Software Requirements

□ RHV 4.2.8 or later ISO

□ RHEL 7.5 or later ISO

□ NVIDIA vGPU 7.0 or later

NVIDIA License Server

### VIRTUAL GPU MANAGER

Download, deploy, verify vGPU Manager:

[root@rhvh tmp]# rpm -ivh NVIDIA-vGPU-	rhel-7.6-410.91.x86_64.rpm	
Preparing	#######################################	[100%]
Updating / installing		
1:NVIDIA-vGPU-rhel-1:7.6-410.91	#######################################	[100%]
[root@rhvh tmp]#		

] T	root@ ue Ma	rhvh ~] r 12 13	]# nvi 3:31:2	dia-smi 3 2019					
ļ	NVIDIA-SMI 410.68 Driver Version: 410.68 CUDA Version: N/A								
	GPU Fan	Name Temp	Perf	Persiste Pwr:Usag	nce-M e/Cap	Bus-Id Dis Memory-Us	p.A age	Volatile GPU-Util	Uncorr. ECC Compute M.
	Θ N/A	Tesla 41C	M10 P8	10W /	0n   53W	00000000:06:00.0 11MiB / 8191	Off MiB	 0%	N/A Default
	1 N/A	Tesla 41C	M10 P8	10W /	0n   53W	00000000:07:00.0 11MiB / 8191	Off MiB	0%	N/A Default
	2 N/A	Tesla 40C	M10 P8	10W /	0n   53W	00000000:08:00.0 11MiB / 8191	Off MiB	0%	N/A Default
	3 N/A	Tesla 40C	M10 P8	10W /	0n   53W	00000000:09:00.0 11MiB / 8191	Off MiB	θ%	N/A Default

#### **VIRTUAL MACHINE CONFIGURATION (1)**

#### Add vGPU profile as mdev device:

Edit Virtual Machine 🛿					×
General		Cluster		Default	~
System				Data Center: Default	
Initial Run		Template		Blank   (0)	~
		Operating System		Red Hat Enterprise Linux 7.x x64	~
Console		Instance Type	63	Custom	~
Host		Optimized for		Desktop	
High Availability	_	mdev_type ~	nvidia	-45	+ -
Resource Allocation					
Boot Options					
Random Generator					
Custom Properties	>				

"mdev": { "nvidia-155": { "name": "GRID M10-2B", "available instances": "4" }, "nvidia-36": { "name": "GRID M10-0Q", "available instances": "16" }, "nvidia-37": { "name": "GRID M10-1A", "available instances": "8" vidia-35": { "name": "GRID M10-0B", "available instances": "16" nvidia-38": { "name": "GRID M10-1B", "available instances": "8" nvidia-39": { "name": "GRID M10-1Q", "available\_instances": "8" nvidia-43": { "name": "GRID M10-4Q", "available instances": "2" vidia-42": { "name": "GRID M10-4A", "available\_instances": "2" vidia-41": { "name": "GRID M10-20", "available instances": "4" nvidia-40": { "name": "GRID M10-2A", "available instances": "4" nvidia-45": { "name": "GRID M10-8Q", "available\_instances": "1" vidia-44": { "name": "GRID M10-8A", "available instances": "1" nvidia-208": { "name": "GRID M10-2B4", "available instances": "4"

#### NVIDIA VGPU PROFILES EXPLAINED

Q - Profiles	Quadro Features Enabled
B - Profiles	Basic Display Driver
A - Profiles	Application Profile

1Q is 1 Gig of Frame Buffer 2B is 2 Gig of Frame Buffer 8A is 8 Gig of Frame Buffer

 $Xq/b/a \rightarrow "X"$  is the amount of Frame Buffer on the Nvidia GPU card

## **VIRTUAL MACHINE CONFIGURATION (2)**

Inside the Linux guest VM install NVIDIA Virtual GPU driver:



### LICENSE SERVER CONFIGURATION

Create a License Server VM and

edit the grid.conf file:

For details on the file format, please refer to the nvidia-gridd(1) man page.

# Description: Set License Server Address
# Data type: string
# Format: "<address>"
ServerAddress=10.31.230.12

# Description: Set License Server port number # Data type: integer # Format: <port>, default is 7070 ServerPort=7070

# Description: Set Backup License Server Address # Data type: string # Format: "<address>" #BackupServerAddress=

# Description: Set Backup License Server port number # Data type: integer # Format: <port>, default is 7070 #BackupServerPort=

# Description: Set Feature to be enabled
# Data type: integer
# Possible values:
# 0 => for unlicensed state
# 1 => for GRID vGPU
# 2 => for Quadro Virtual Datacenter Workstation
FeatureType=1

# Description: Parameter to enable or disable Grid Licensing tab in nvidia-settings
# Data type: boolean
# Possible values: TRUE or FALSE, default is FALSE
#EnableUI=TRUE

# Description: Set license borrow period in minutes
# Data type: integer
# Possible values: 10 to 10080 mins(7 days), default is 1440 mins(1 day)
#LicenseInterval=1440

# Description: Set license linger period in minutes
# Data type: integer
# Possible values: 0 to 10080 mins(7 days), default is 0 mins
#LingerInterval=10
[root@centos7-kym tmp]#

#### **VIRTUAL GPU MANAGER** Download, deploy, verify vGPU Manager:



### VIRTUAL MACHINE CONFIGURATION

Red Hat Virtualization Manag	ige 🗙 🧏 System - fw1-rhv2.sigg	gtonium × +					- 0
-> C ∩	🛈 🔒 https://fw1-	-rhvm1.siggtonium.com	/ovirt-engine/webadmin/?locale=en_	US#hosts-devices;name=fw1-rhv1			… ◙ ☆ ⊻ Ⅲ\ ①
	TUALIZATION						<b>⋈ ॐ ≅° 4° 0</b> √ .
Dashboard	Compute » Hosts » fw	v1-rhv1 =				Edit Rem	ove Management v Installation v Host Console
Compute >							
	General Virtual Mac	chines Network Int	erfaces Host Devices Host	Hooks Permissions Affinity Labels Errata	Events Red Hat Documentation		1.120
🗄 Network 💦 🗦	Name	is_assignable": "t	rue",		use by Attached to VMs	IOMMU Group	1 - 139 <
	pci_000	parent": "pci_0000	_08_00_0"	Connect to your RHV host	and run	N/A	
Storage >	pci_000			vdsm-client Host hostdevLi	stByCaps	N/A	
	pci_000 "block_sda	a_ST1000DX002_2DV1	62_Z4YEK8JT": {	This will give you a list of t	he vGPU profiles.	N/A	
Administratio	pci_000	ms": { capability": "stor	age",			N/A	
Auministration >	pci_000	is_assignable": "t	rue",	ch Pad Regist		N/A	
	pci_000	vendor": "ATA",	NOOT-TRAT.'	status and RAS Regis		N/A	
Events	pci_000	parent": "scsi_1_0		prottle Registers (0x3438)		N/A	
	pci_000			ata Technology Device (0x34	ioatdma	N/A	
	pci_000 "parat			ata Technology Device (0x34	ioatdma	N/A	
	pci 000	capability": "usb"	/ ////	ata Technology Device (0x34	ioatdma	N/A	
	pci 000	driver": "hub",	4.000 y	ata Technology Device (0x34	ioatdma	N/A	
	pci_000	parent": "usb_usb8		ata Technology Device (0x34	ioatdma	N/A	
	pci_000			ata Technology Device (0x34	ioatdma	N/A	
	pci_000 [root@fwl-rhv	2 ~]# vdsm-client	Host hostdevListByCaps	✓ ata Technology Device (0x34	ioatdma	N/A	
	pci_0000_00_16_7	pci	Intel Corporation (0x8086)	5520/5500/X58 Chipset QuickData Technology Device (0x34	ioatdma	N/A	
	pci_0000_01_03_0	pci	Matrox Electronics Systems Ltd	MGA G200eW WPCM450 (0x0532)	mgag200	N/A	
	pci_0000_02_00_0	pci	PLX Technology, Inc. (0x10b5)	PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switc	pcieport	N/A	
	pci_0000_03_08_0	pci	PLX Technology, Inc. (0x10b5)	PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switc	pcieport	N/A	
	pci_0000_03_10_0	pci	PLX Technology, Inc. (0x10b5)	PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switc	pcieport	N/A	
	pci_0000_04_00_0	pci	NVIDIA Corporation (0x10de)	GM204GL [Tesla M60] (0x13f2)	nvidia	N/A	nvidia-11, nvidia-12, nvidia-13, nvidia-14, nvidia-15, nv
	pci_0000_05_00_0	pci	NVIDIA Corporation (0x10de)	GM204GL [Tesla M60] (0x13f2)	nvidia	N/A	nvidia-11, nvidia-12, nvidia-13, nvidia-14, nvidia-15, nv
	pci_0000_08_00_0	pci	Intel Corporation (0x8086)	82576 Gigabit Network Connection (0x10c9)	igb	N/A	
	pci_0000_08_00_1	pci	Intel Corporation (0x8086)	82576 Gigabit Network Connection (0x10c9)	igb	N/A	
	pci_0000_fe_00_0	pci	Intel Corporation (0x8086)	Xeon 5600 Series QuickPath Architecture Generic Non-core		N/A	
	pci_0000_fe_00_1	pci	Intel Corporation (0x8086)	Xeon 5600 Series QuickPath Architecture System Address		N/A	
	pci_0000_fe_02_0	pci	Intel Corporation (0x8086)	Xeon 5600 Series QPI Link 0 (0x2d90)		N/A	
	pci_0000_fe_02_1	pci	Intel Corporation (0x8086)	Xeon 5600 Series QPI Physical 0 (0x2d91)		N/A	
	pci_0000_fe_02_2	pci	Intel Corporation (0x8086)	Xeon 5600 Series Mirror Port Link 0 (0x2d92)		N/A	
	pci_0000_fe_02_3	pci	Intel Corporation (0x8086)	Xeon 5600 Series Mirror Port Link 1 (0x2d93)		N/A	
		pci	Intel Corporation (0x8086)	Xeon 5600 Series QPI Link 1 (0x2d94)		N/A	
	pci_0000_fe_02_4	(P					
	pci_0000_fe_02_4	pci	Intel Corporation (0x8086)	Xeon 5600 Series QPI Physical 1 (0x2d95)		N/A	

"mdev": { "nvidia-155": { "name": "GRID M10-2B", "available instances": "4" }, "nvidia-36": { "name": "GRID M10-0Q",
"available\_instances": "16" }, "nvidia-37": { "name": "GRID M10-1A", "available instances": "8" "nvidia-35": { "name": "GRID M10-0B", "available instances": "16" "nvidia-38": { "name": "GRID M10-1B", "available\_instances": "8" "nvidia-39": { "name": "GRID M10-1Q", "available\_instances": "8" "nvidia-43": { "name": "GRID M10-4Q", "available instances": "2" "nvidia-42": { "name": "GRID M10-4A", "available instances": "2" }. "nvidia-41": { "name": "GRID M10-2Q",
"available\_instances": "4" "nvidia-40": { "name": "GRID M10-2A", "available instances": "4" "nvidia-45": { "name": "GRID M10-8Q", "available instances": "1" "nvidia-44": { "name": "GRID M10-8A", "available instances": "1" "nvidia-208": { "name": "GRID M10-2B4",
"available\_instances": "4"

### VIRTUAL MACHINE CONFIGURATION (2)

#### Inside the guest VM install NVIDIA Virtual GPU driver:



# Thank you.

