07_CVD: NVAIE Host Driver Post-Deployment

Verify that GPU is licensed on the ESXi host

Deployment Steps:

1. SSH as root into the ESXi host with GPU and verify that the host can see the GPU.

```
[root@FSV-ESXi-Host-11:~] lspci | grep NVIDIA
0000:39:00.0 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:00.4 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:00.5 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:00.6 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:00.7 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.0 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.1 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.2 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.3 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.4 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.5 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.6 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:01.7 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.0 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.1 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.2 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.3 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.4 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.5 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.6 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
0000:39:02.7 3D controller: NVIDIA Corporation NVIDIA A100-PCIE-80GB
[root@FSV-ESXi-Host-11:~]
```

2. Verify that the NVIDIA vGPU software package installed and loaded correctly by checking for the NVIDIA kernel driver in the list of kernels loaded modules.

```
[root@FSV-ESXi-Host-11:~] vmkload_mod -l | grep nvidia
nvidia 54 52136
```

3. Verify that the NVIDIA kernel driver can successfully communicate with the NVIDIA physical GPUs in your system by running the nvidia-smi command.

```
[root@FSV-ESXi-Host-11:/tmp] nvidia-smi
Mon Oct 30 17:17:37 2023
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 525.60.12 Driver Version: 525.60.12 CUDA Version: N/A |
|-------------------------------+----------------------+----------------------+
| GPU Name Persistence-M| Bus-Id Disp.A | Volatile Uncorr. ECC |
| Fan Temp Perf Pwr:Usage/Cap| Memory-Usage | GPU-Util Compute M. |
| | | MIG M. |
|===============================+======================+======================|
| 0 NVIDIA A100 80G... On | 00000000:39:00.0 Off | 0 |
| N/A 34C P0 47W / 300W | 0MiB / 81920MiB | 0% Default |
| | | Disabled |
+-------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes: |
| GPU GI CI PID Type Process name GPU Memory |
| ID ID Usage |
|=============================================================================|
| No running processes found |
+-----------------------------------------------------------------------------+
[root@FSV-ESXi-Host-13:/tmp]
```

4. Confirm that the GPU is licensed - it can cause performance issues otherwise.

```
[root@FSV-ESXi-Host-11:~] nvidia-smi -q

==============NVSMI LOG==============

Timestamp : Mon Oct 23 03:09:16 2023
Driver Version : 525.60.12
CUDA Version : Not Found
vGPU Driver Capability
Heterogenous Multi-vGPU : Supported

Attached GPUs : 1
GPU 00000000:39:00.0
Product Name : NVIDIA A100 80GB PCIe
Product Brand : NVIDIA
Product Architecture : Ampere
Display Mode : Enabled
Display Active : Disabled
Persistence Mode : Enabled
vGPU Device Capability
```

```
Heterogeneous Time-Slice Profiles : Supported
Heterogeneous Time-Slice Sizes : Not Supported
MIG Mode
Current : Disabled
Pending : Disabled
Accounting Mode : Enabled
Accounting Mode Buffer Size : 4000
Driver Model
Current : N/A
Pending : N/A
Serial Number : 1650723016792
GPU UUID : GPU-730f04ba-c78e-a0c3-ab6c-a7742c7e5954
Minor Number : 0
VBIOS Version : 92.00.A0.00.05
MultiGPU Board : No
Board ID : 0x3900
Board Part Number : 900-21001-6220-130
GPU Part Number : 20B5-893-A1
Module ID : 0
Inforom Version
Image Version : 1001.0230.00.03
OEM Object : 2.0
ECC Object : 6.16
Power Management Object : N/A
GPU Operation Mode
Current : N/A
Pending : N/A
GSP Firmware Version : N/A
GPU Virtualization Mode
Virtualization Mode : Host VGPU
Host VGPU Mode : SR-IOV
IBMNPU
Relaxed Ordering Mode : N/A
PCI
Bus : 0x39
Device : 0x00
Domain : 0x0000
Device Id : 0x20B510DE
Bus Id : 00000000:39:00.0
Sub System Id : 0x153310DE
GPU Link Info
PCIe Generation
Max : 4
Current : 4
Device Current : 4
Device Max : 4
Host Max : N/A
```

```
Link Width
Max : 16x
Current : 8x
Bridge Chip
Type : N/A
Firmware : N/A
Replays Since Reset : 0
Replay Number Rollovers : 0
Tx Throughput : 0 KB/s
Rx Throughput : 0 KB/s
Atomic Caps Inbound : N/A
Atomic Caps Outbound : N/A
Fan Speed : N/A
Performance State : P0
Clocks Throttle Reasons
Idle : Active
Applications Clocks Setting : Not Active
SW Power Cap : Not Active
HW Slowdown : Not Active
HW Thermal Slowdown : Not Active
HW Power Brake Slowdown : Not Active
Sync Boost : Not Active
SW Thermal Slowdown : Not Active
Display Clock Setting : Not Active
FB Memory Usage
Total : 81920 MiB
Reserved : 691 MiB
Used : 0 MiB
Free : 81228 MiB
BAR1 Memory Usage
Total : 131072 MiB
Used : 1 MiB
Free : 131071 MiB
Compute Mode : Default
Utilization
Gpu : 0 %
Memory : 0 %
Encoder : 0 %
Decoder : 0 %
Encoder Stats
Active Sessions : 0
Average FPS : 0
Average Latency : 0
FBC Stats
Active Sessions : 0
Average FPS : 0
Average Latency : 0
```

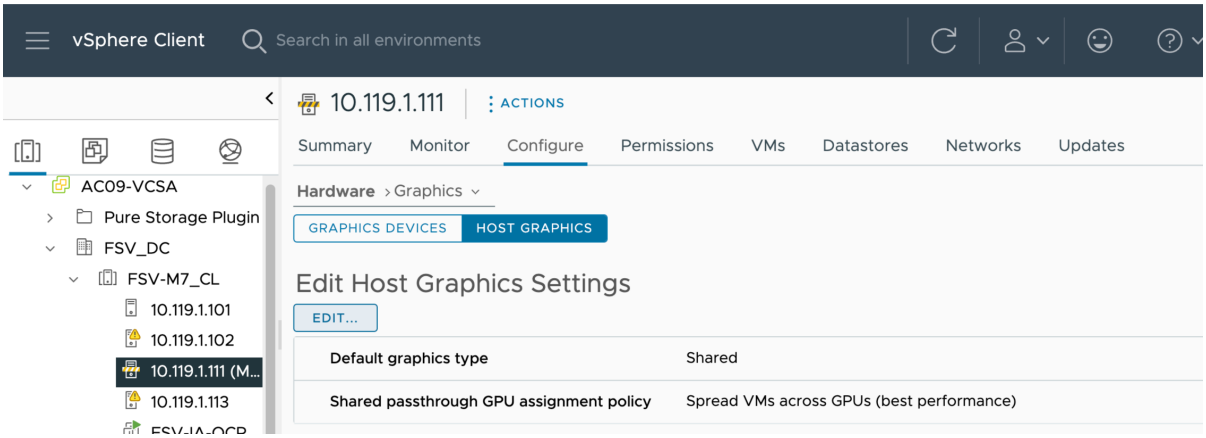
```
Ecc Mode
Current : Enabled
Pending : Enabled
ECC Errors
Volatile
SRAM Correctable : 0
SRAM Uncorrectable : 0
DRAM Correctable : 0
DRAM Uncorrectable : 0
Aggregate
SRAM Correctable : 0
SRAM Uncorrectable : 0
DRAM Correctable : 0
DRAM Uncorrectable : 0
Retired Pages
Single Bit ECC : N/A
Double Bit ECC : N/A
Pending Page Blacklist : N/A
Remapped Rows
Correctable Error : 0
Uncorrectable Error : 0
Pending : No
Remapping Failure Occurred : No
Bank Remap Availability Histogram
Max : 640 bank(s)
High : 0 bank(s)
Partial : 0 bank(s)
Low : 0 bank(s)
None : 0 bank(s)
Temperature
GPU Current Temp : 35 C
GPU Shutdown Temp : 92 C
GPU Slowdown Temp : 89 C
GPU Max Operating Temp : 85 C
GPU Target Temperature : N/A
Memory Current Temp : 37 C
Memory Max Operating Temp : 95 C
Power Readings
Power Management : Supported
Power Draw : 47.88 W
Power Limit : 300.00 W
Default Power Limit : 300.00 W
Enforced Power Limit : 300.00 W
Min Power Limit : 150.00 W
Max Power Limit : 300.00 W
Clocks
Graphics : 210 MHz
```

```
SM : 210 MHz
Memory : 1512 MHz
Video : 795 MHz
Applications Clocks
Graphics : 1410 MHz
Memory : 1512 MHz
Default Applications Clocks
Graphics : 1410 MHz
Memory : 1512 MHz
Deferred Clocks
Memory : N/A
Max Clocks
Graphics : 1410 MHz
SM : 1410 MHz
Memory : 1512 MHz
Video : 1290 MHz
Max Customer Boost Clocks
Graphics : 1410 MHz
Clock Policy
Auto Boost : N/A
Auto Boost Default : N/A
Voltage
Graphics : 706.250 mV
Fabric
State : N/A
Status : N/A
Processes : None

[root@FSV-ESXi-Host-11:~]
```

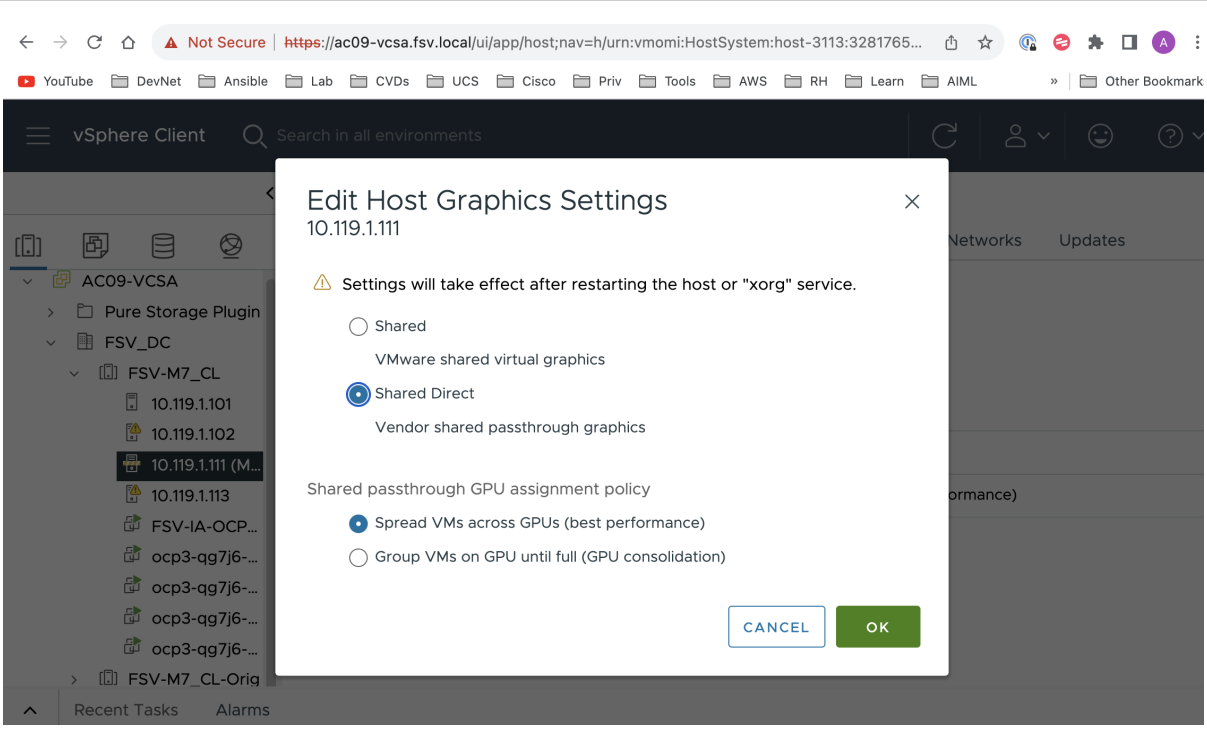
Change GPU Graphics Type to vGPU

The same host driver supports both Virtual Shared Graphics Acceleration (vSGA) and vGPU functions. Change the default Graphics Type from Virtual Shared Graphics Acceleration (vSGA) to vGPU (**Shared Direct**).

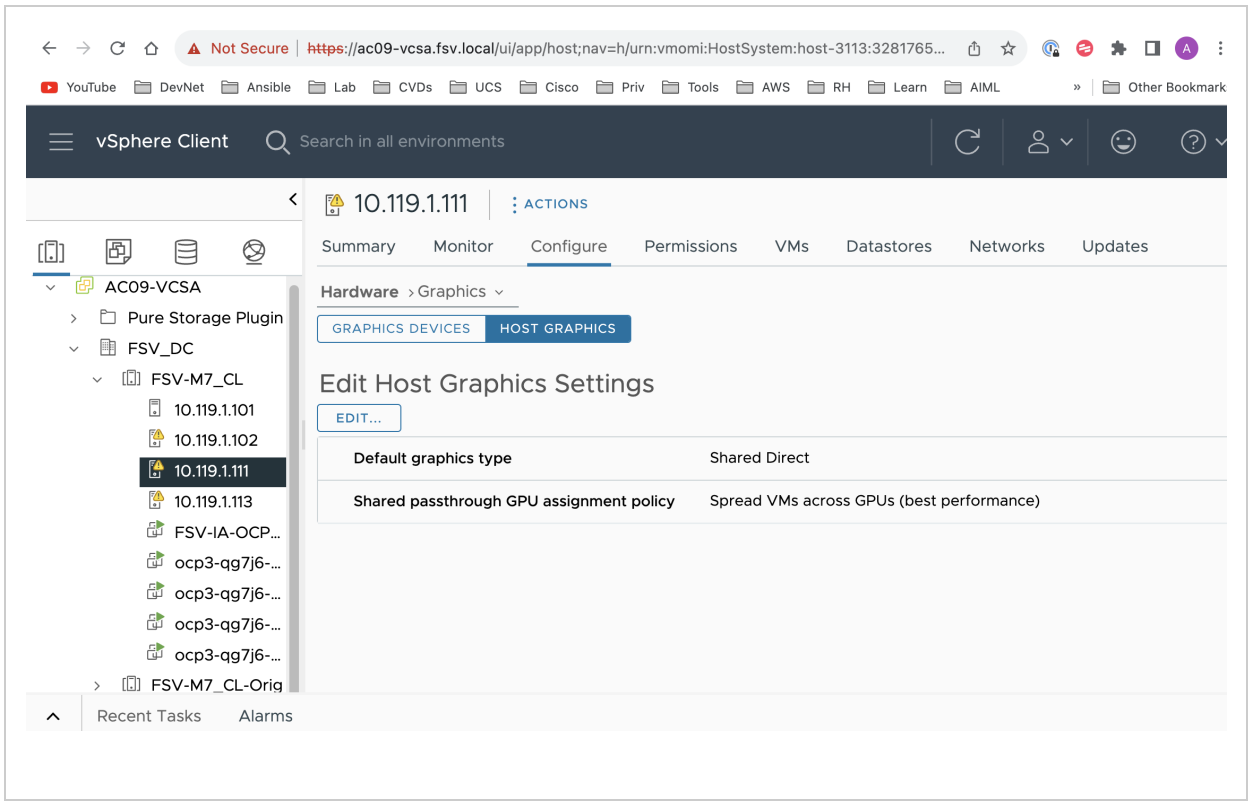
1. From VMware vCenter, navigate to vSphere cluster and host with the GPU. Select **Configure > hardware > Graphics.**



2. Click on **EDIT...**



3. Change the graphics type.



Verify that GPU is licensed on the ESXi host

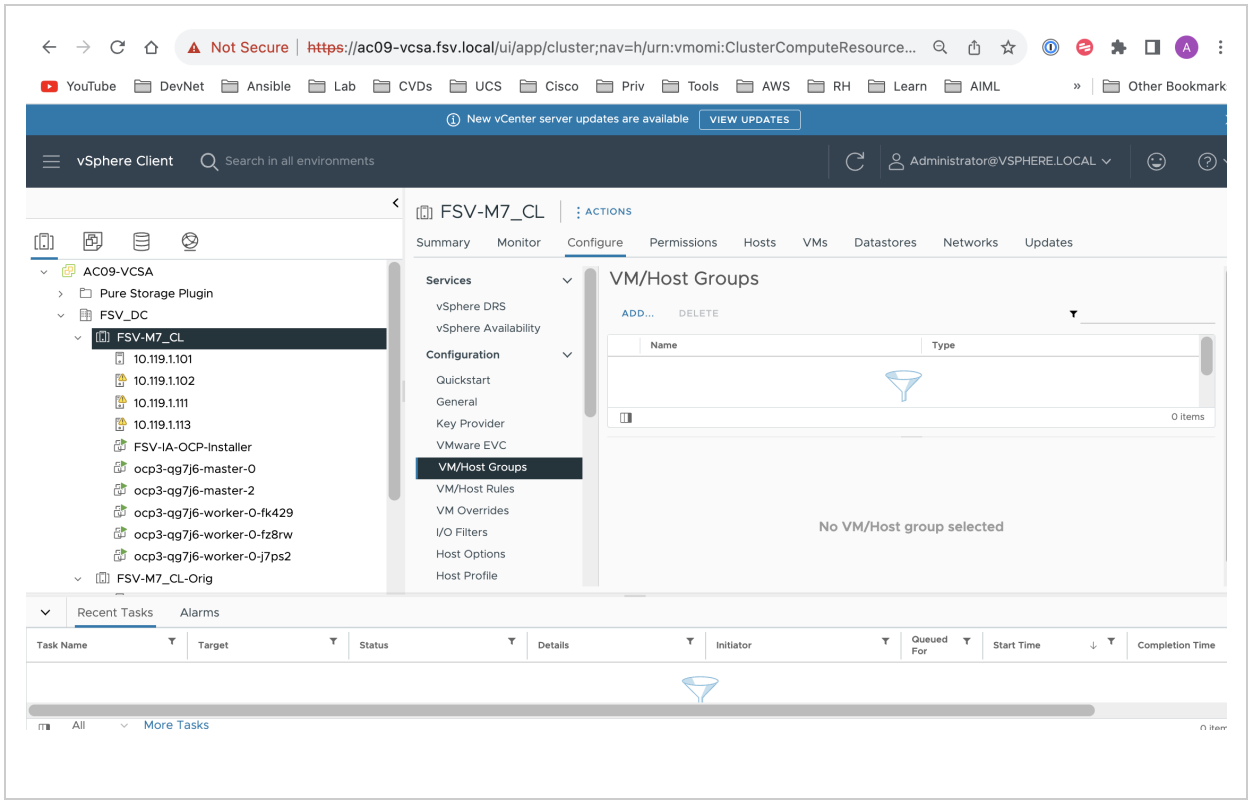
- SSH into ESXi and confirm **GPU Virtualization Mode** is **Host VGPU** and **Host VGPU Mode** is **SR-IOV**.

```
[root@FSV-ESXi-Host-11:~] nvidia-smi -q | grep Virtual
GPU Virtualization Mode
Virtualization Mode : Host VGPU. <<<<<<<<<<<<<<<<<<<

[root@FSV-ESXi-Host-11:~] nvidia-smi -q | grep vGPU
vGPU Driver Capability
Heterogenous Multi-vGPU : Supported
vGPU Device Capability
Fractional Multi-vGPU : Supported

[root@FSV-ESXi-Host-11:~] nvidia-smi -q | grep VGPU
Virtualization Mode : Host VGPU
Host VGPU Mode : SR-IOV. <<<<<<<<<<<<<<<<<<<
```

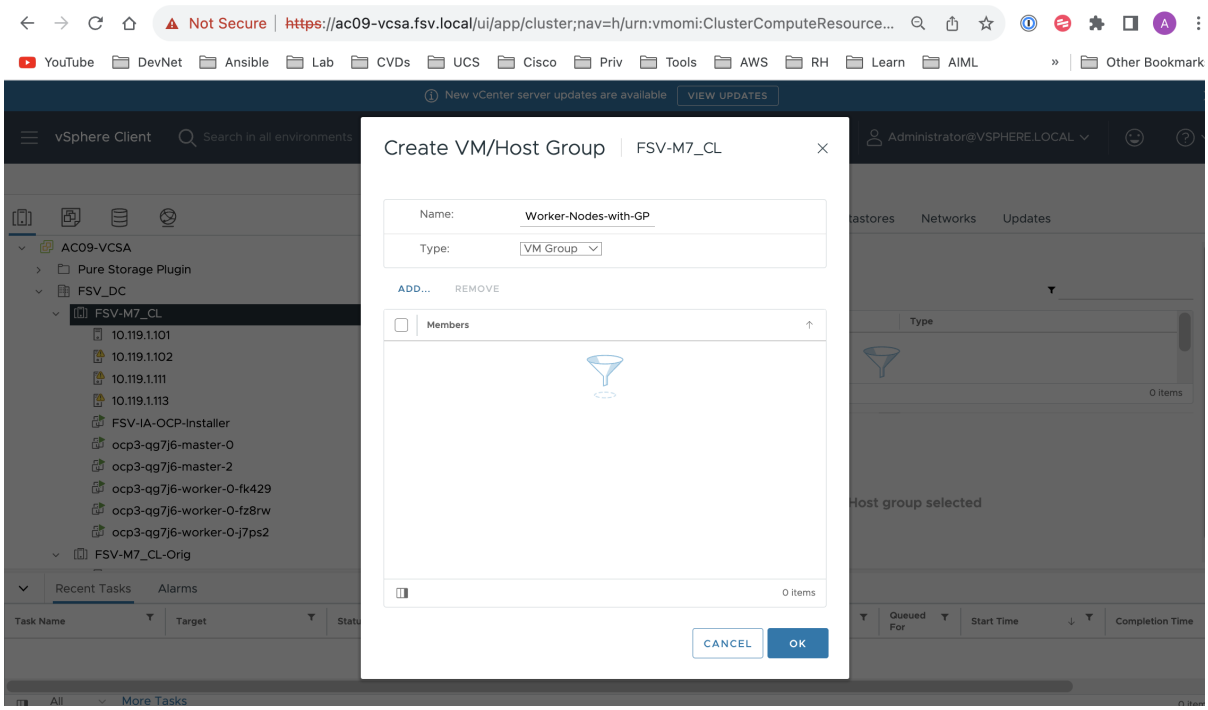
Configure Host/VM Affinity Rules

Host/VM Affinity rules will enable Red Hat OCP worker nodes that will run AI/ML workloads to use hosts with GPUs installed.

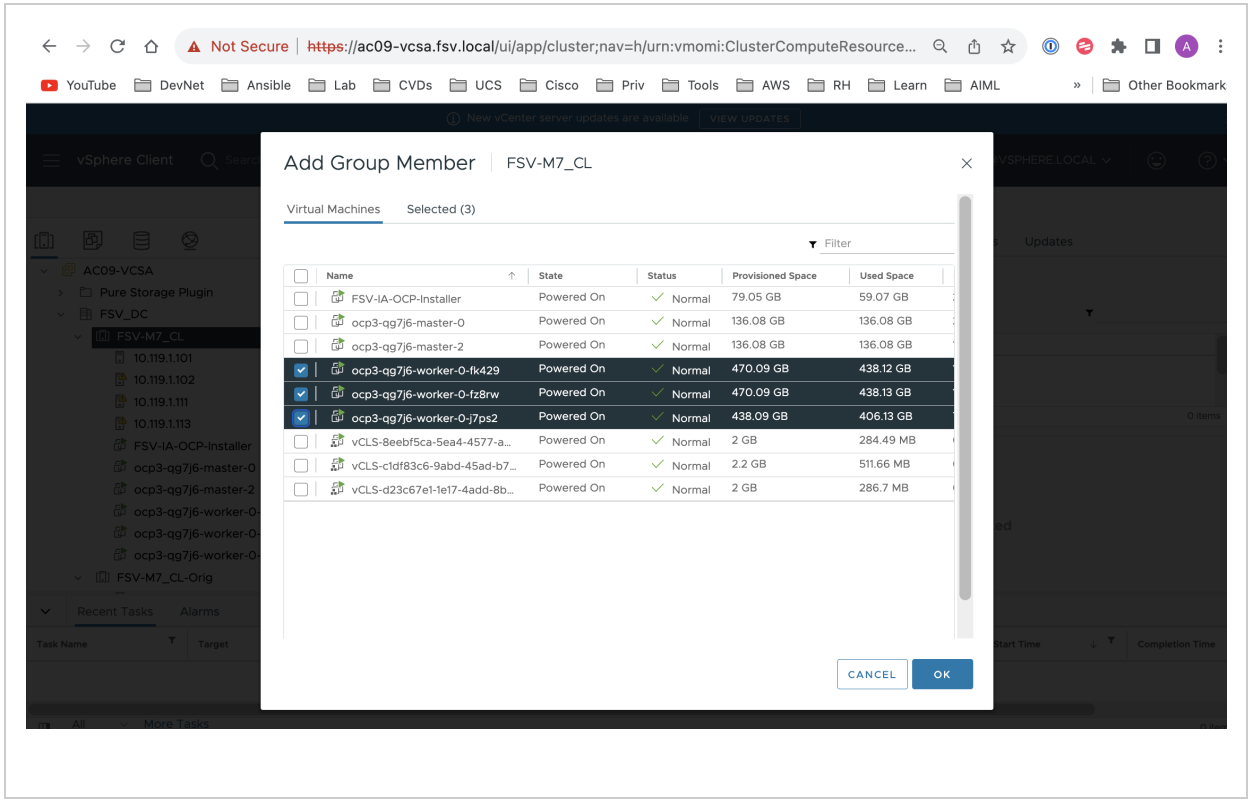
1. From VMware vCenter, navigate to vSphere cluster. Select **Configure > Configuration > VM/Host Groups**.



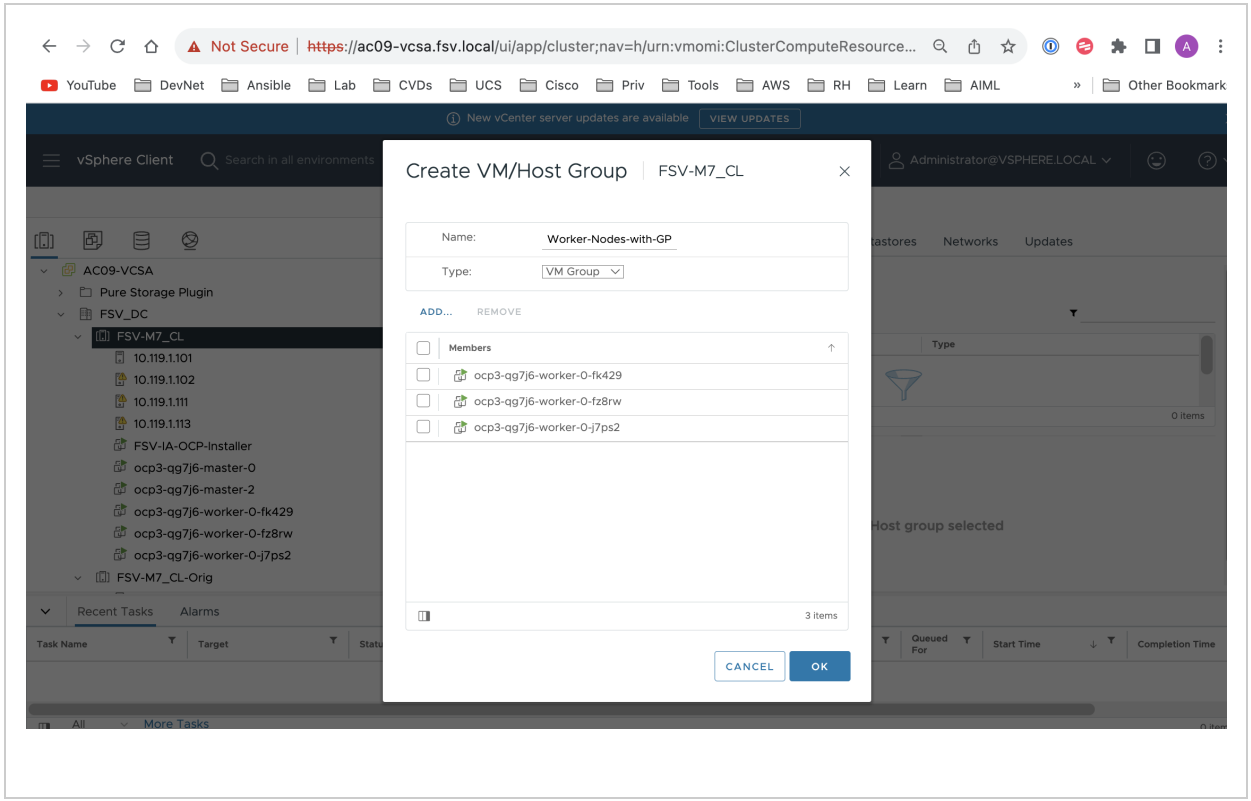
2. Create a VM group for OCP worker nodes that need GPUs. Click on **ADD...** to add worker node VMs to a VM Group with GPUs.

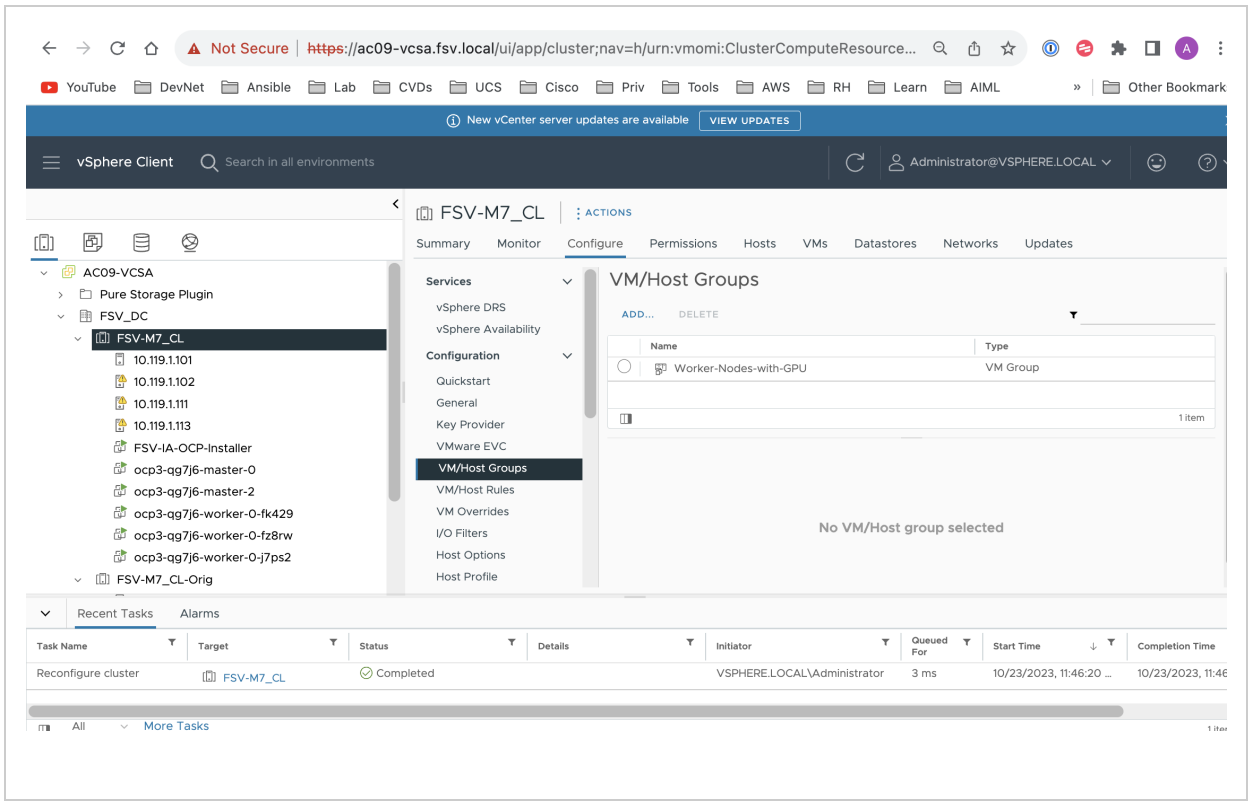


3. Select OCP worker nodes to add to the VM Group. Click **OK.**

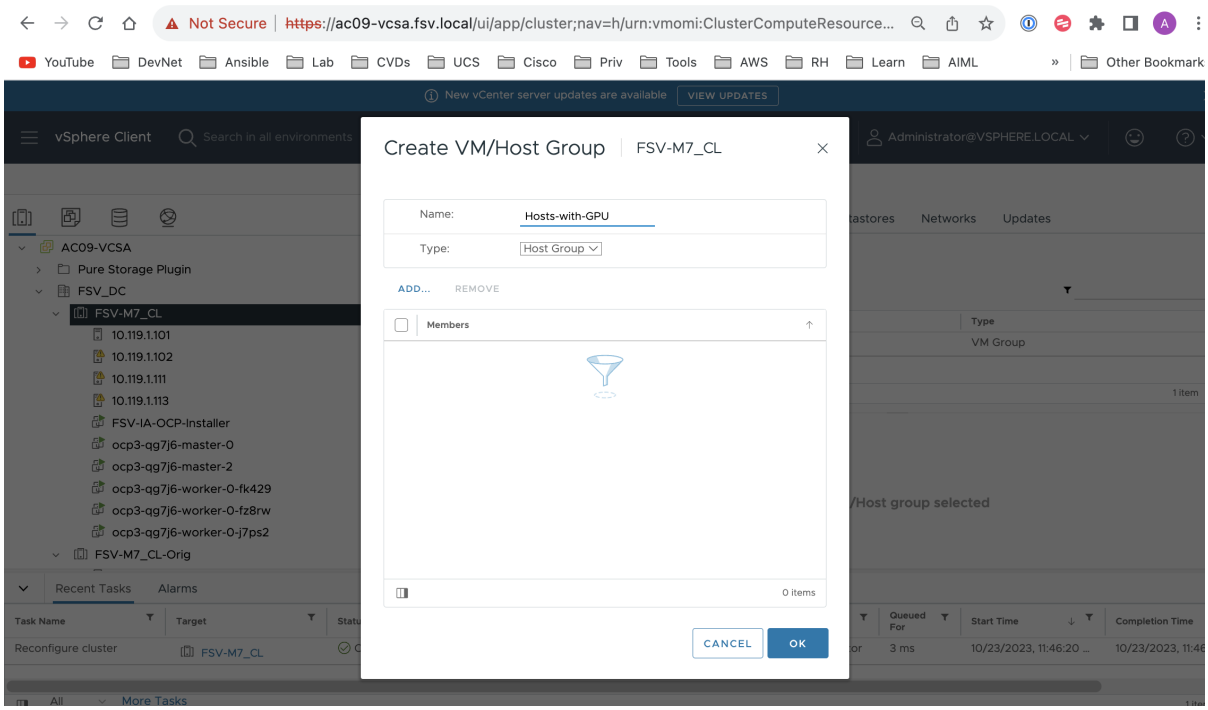

Not Secure
https://ac09-vcsa.fsv.local/ui/app/cluster;nav=h/urn:vmomi:ClusterComputeResource...
YouTube
DevNet
Ansible
Lab
CVDs
UCS
Cisco
Priv
Tools
AWS
RH
Learn
AIML
Other Bookmark
vSphere Client
Add Group Member
FSV-M7_CL
Virtual Machines
Selected (3)
Filter
Name
State
Status
Provisioned Space
Used Space
FSV-IA-OCP-Installer Powered On Normal 79.05 GB 59.07 GB
ocp3-qg7j6-master-0 Powered On Normal 136.08 GB 136.08 GB
ocp3-qg7j6-master-2 Powered On Normal 136.08 GB 136.08 GB
ocp3-qg7j6-worker-0-fk429 Powered On Normal 470.09 GB 438.12 GB
ocp3-qg7j6-worker-0-fz8rw Powered On Normal 470.09 GB 438.13 GB
ocp3-qg7j6-worker-0-j7ps2 Powered On Normal 438.09 GB 406.13 GB
vCLS-8eebf5ca-5ea4-4577-a... Powered On Normal 2 GB 284.49 MB
vCLS-c1df83c6-9abd-45ad-b7... Powered On Normal 2.2 GB 511.66 MB
vCLS-d23c67e1-1e17-4add-8b... Powered On Normal 2 GB 286.7 MB
CANCEL
OK

4. Click **OK**.

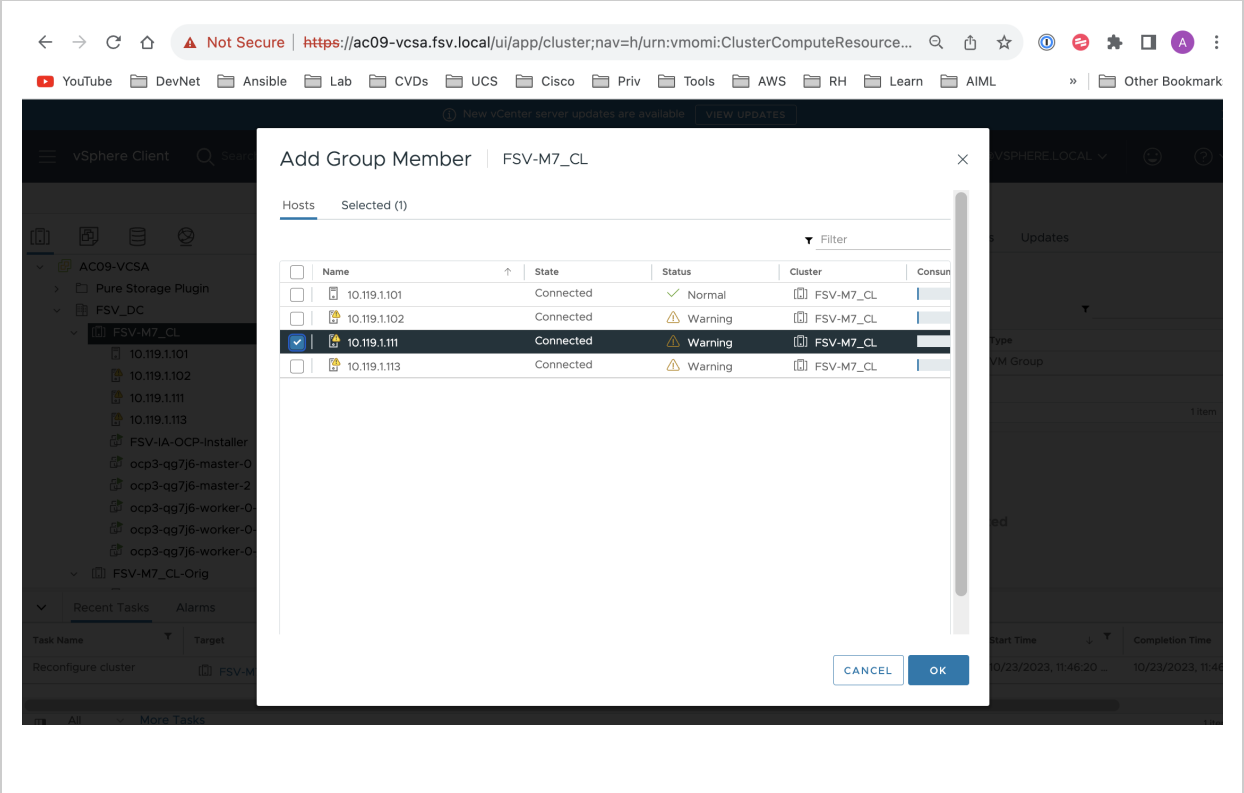

Not Secure | https://ac09-vcsa.fsv.local/ui/app/cluster;nav=h/urn:vmomi:ClusterComputeResource...
YouTube DevNet Ansible Lab CVDs UCS Cisco Priv Tools AWS RH Learn AIML Other Bookmark
New vCenter server updates are available VIEW UPDATES
vSphere Client Search in all environments Administrator@VSPHERE.LOCAL
AC09-VCSA
Pure Storage Plugin
FSV_DC
FSV-M7_CL
10.119.1.101
10.119.1.102
10.119.1.111
10.119.1.113
FSV-IA-OCP-Installer
ocp3-qg7j6-master-0
ocp3-qg7j6-master-2
ocp3-qg7j6-worker-0-fk429
ocp3-qg7j6-worker-0-fz8rw
ocp3-qg7j6-worker-0-j7ps2
FSV-M7_CL-Orig
Networks Updates
Type
0 items
Host group selected
Recent Tasks Alarms
Task Name Target Queued For Start Time Completion Time
All More Tasks
Create VM/Host Group FSV-M7_CL
Name: Worker-Nodes-with-GP
Type: VM Group
ADD... REMOVE
Members
ocp3-qg7j6-worker-0-fk429
ocp3-qg7j6-worker-0-fz8rw
ocp3-qg7j6-worker-0-j7ps2
3 items
CANCEL OK



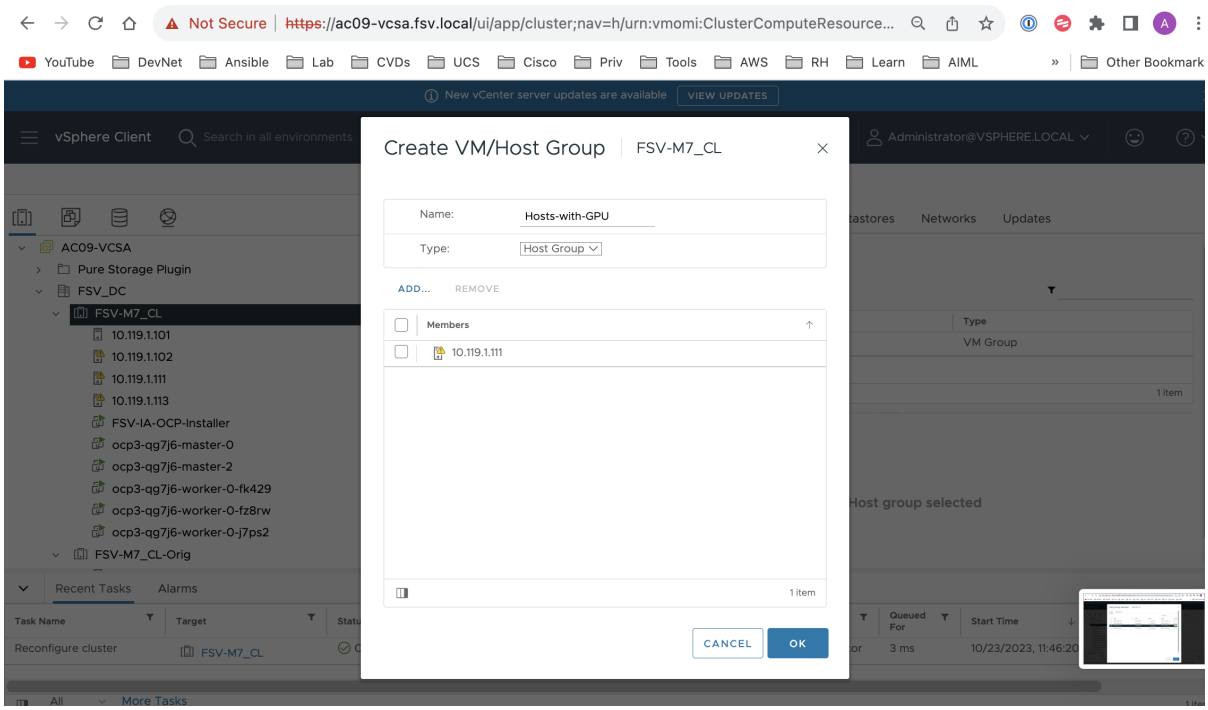
5. Create Host Group for Hosts with GPUs installed. Click **ADD...**



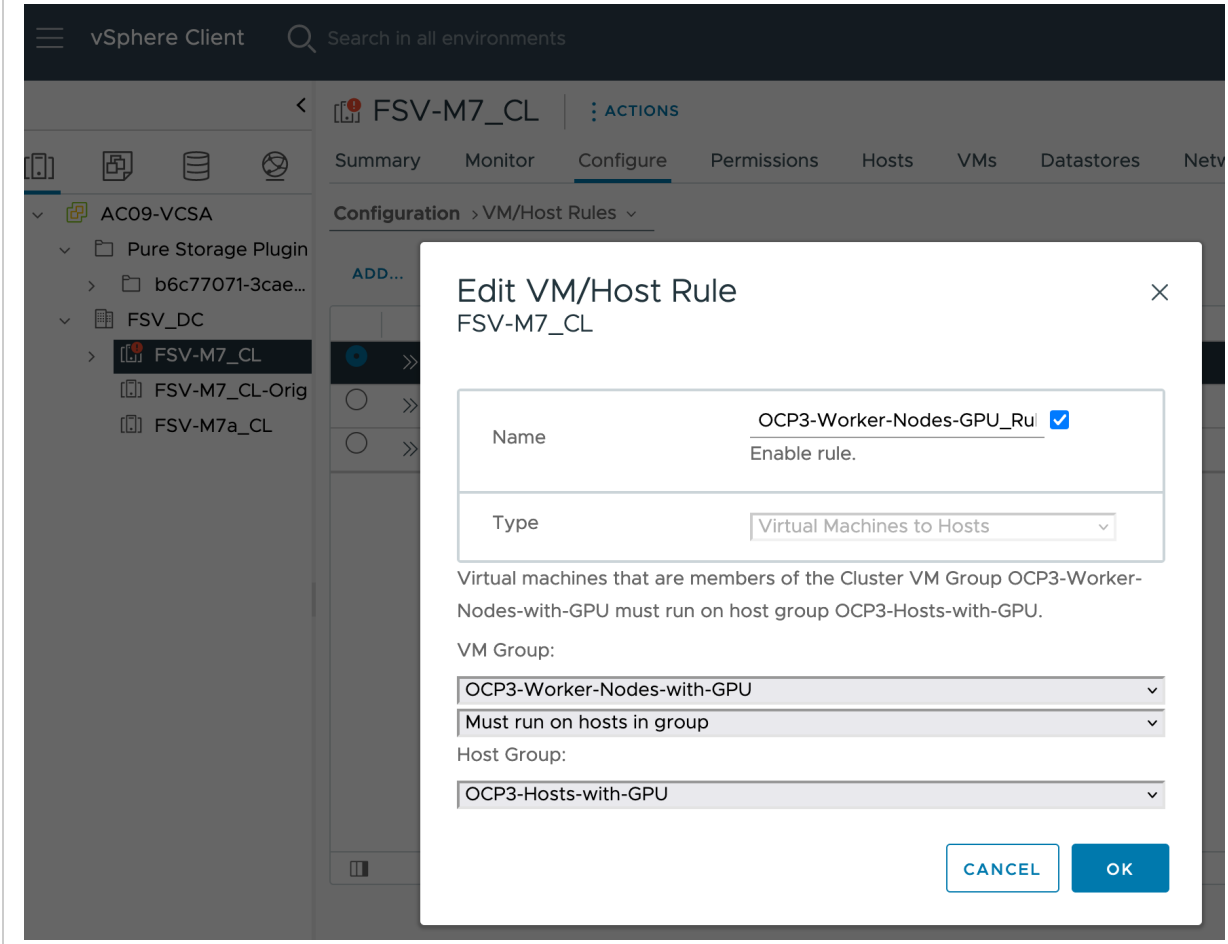
6. Select hosts with GPU. Click **OK.**



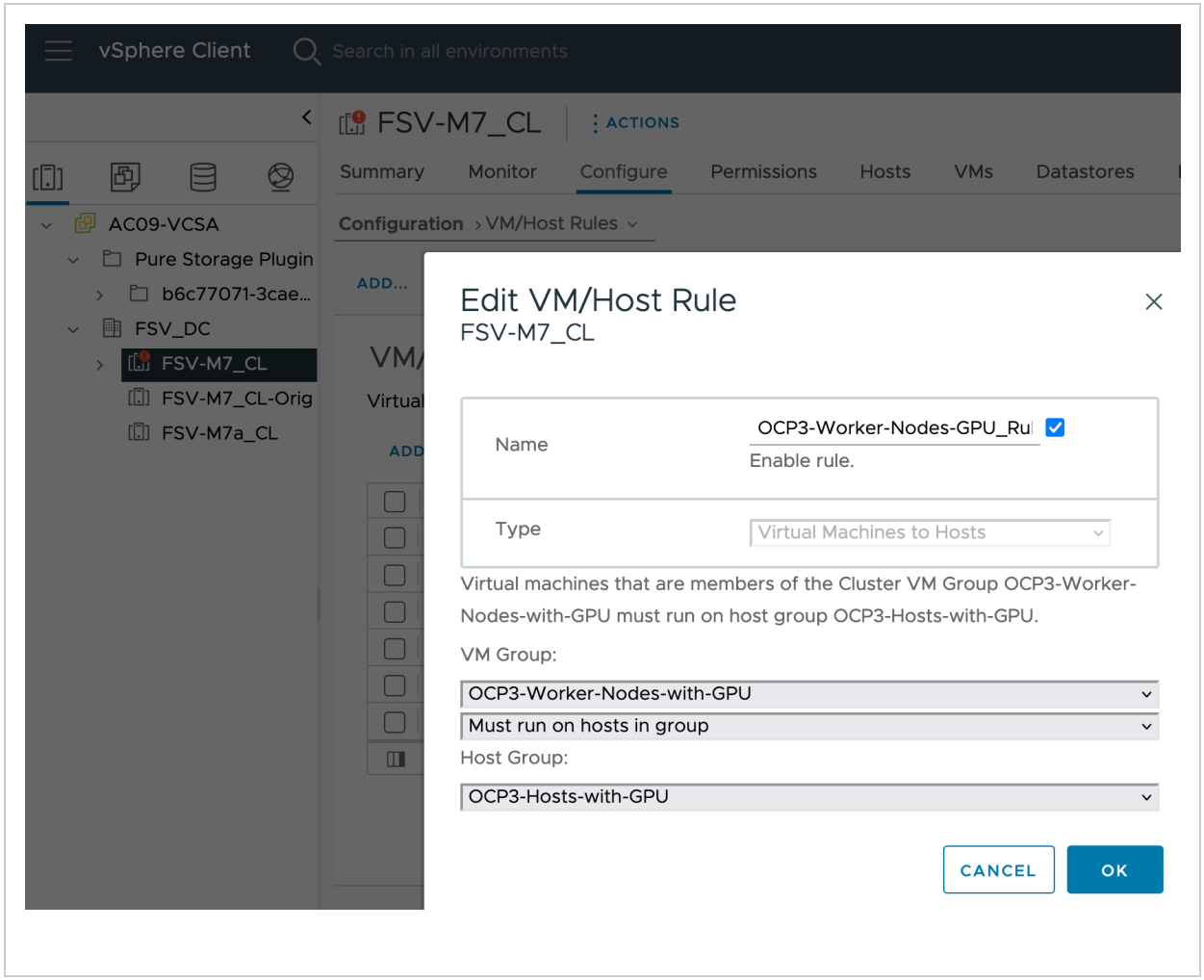
7. Click **OK** again.

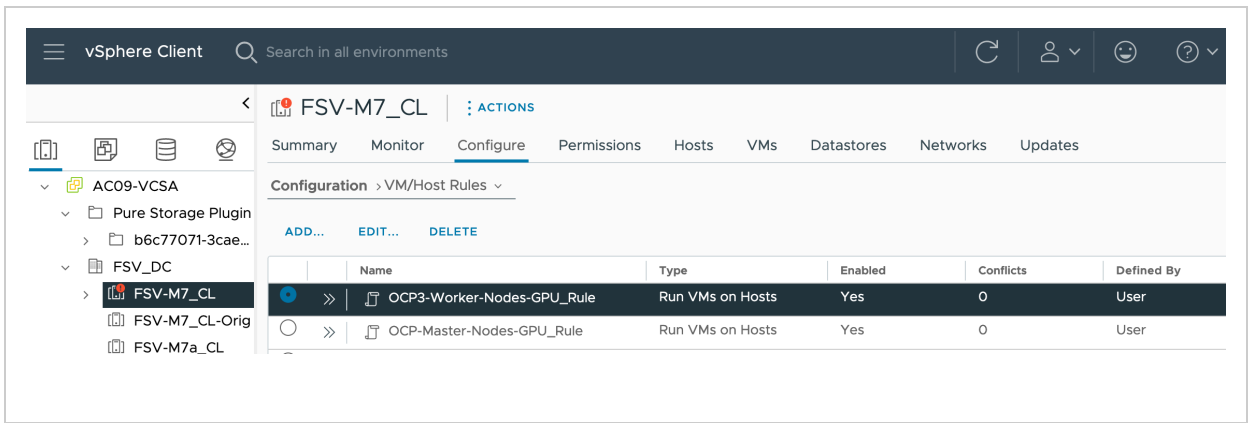


8. Create VM/Host Rules for the VM and Host Groups created. From VMware vCenter, navigate to vSphere cluster. Select **Configure > Configuration > VM/Host Rule**.
9. In the **Create VM/Host Rule** pop-up window, provide a name. Select **Virtual Machines To Hosts** for the Type. From the drop-down list, select the previously created **VM Group**. Select **Must run on hosts in group** and select previously created **Host Group** with GPUs. Check the **Enable rule** check box if it is not already enabled. Click on **OK.**



10. Create a similar rule to keep master nodes on non-GPU nodes. Click **OK.**


vSphere Client
Search in all environments
FSV-M7_CL
ACTIONS
Summary
Monitor
Configure
Permissions
Hosts
VMs
Datastores
Configuration
VM/Host Rules
ADD...
AC09-VCSA
Pure Storage Plugin
b6c77071-3cae...
FSV_DC
FSV-M7_CL
FSV-M7_CL-Orig
FSV-M7a_CL
Edit VM/Host Rule
FSV-M7_CL
Name
OCP3-Worker-Nodes-GPU_Ru
Enable rule.
Type
Virtual Machines to Hosts
Virtual machines that are members of the Cluster VM Group OCP3-Worker-Nodes-with-GPU must run on host group OCP3-Hosts-with-GPU.
VM Group:
OCP3-Worker-Nodes-with-GPU
Must run on hosts in group
Host Group:
OCP3-Hosts-with-GPU
CANCEL
OK


vSphere Client
Search in all environments
FSV-M7_CL
ACTIONS
Summary
Monitor
Configure
Permissions
Hosts
VMs
Datastores
Networks
Updates
Configuration
VM/Host Rules
ADD...
EDIT...
DELETE
Name
Type
Enabled
Conflicts
Defined By
OCP3-Worker-Nodes-GPU_Rule
Run VMs on Hosts
Yes
0
User
OCP-Master-Nodes-GPU_Rule
Run VMs on Hosts
Yes
0
User