Nvidia GPU workload test on SUSE/Rancher stack.

To create Nvidia GPU container based driver review >

https://github.com/alexarnoldy/technical-reference-documentation/blob/nvidia-operator-on-BCI/kubernetes/start/nvidia/adoc/gs_rke2_nvidia-gpu-operator.adoc

or

https://documentation.suse.com/trd/kubernetes/pdf/gs_rke2-slebci_nvidia-gpu-operator_en.pdf

In this test example container-based Nvidia GPU driver was created for SLES15 and pushed on the local repo.

DRIVER_VERSION="535.104.05"

OPERATOR_VERSION="v23.9.0"

CUDA_VERSION="12.2.2"

GPU-OPERATOR config has a reference of the local repo.

```
  nvidiaDriverCRD:
    deployDefaultCR: true
    driverType: gpu
    enabled: false
    nodeSelector: {}
  rdma:
    enabled: false
    useHostMofed: false
  repoConfig:
    configMapName: ''
  repository: isv-registry.susealliances.com
  resources: {}
  startupProbe:
    failureThreshold: 120
    initialDelaySeconds: 60
    periodSeconds: 10
```

To run a workload test: (need to use a VPN for the cluster access)

Go to

https://le1.isv.suse from your browser (need to be on lab VPN and have the following records in your local laptop /etc/hosts file:

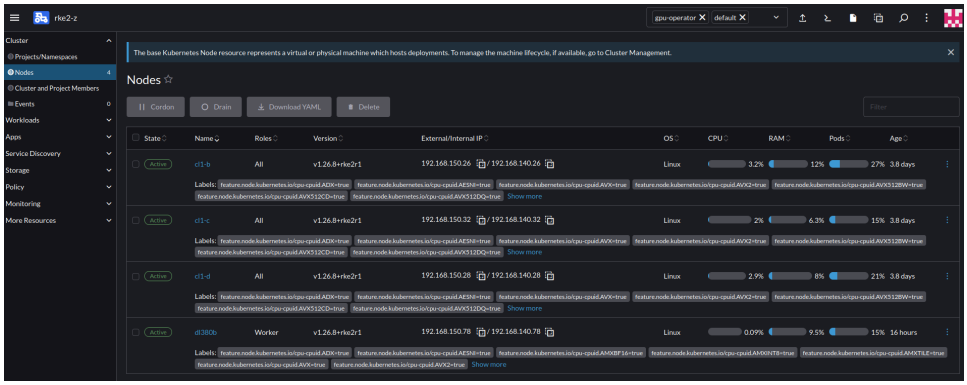
192.168.150.16 le1.isv.suse le1

==========

Login to the Rancher server dashboard (admin/Suse_1234567)

Go to the rke2 cluster

Check deployed nodes in the cluster and their roles:

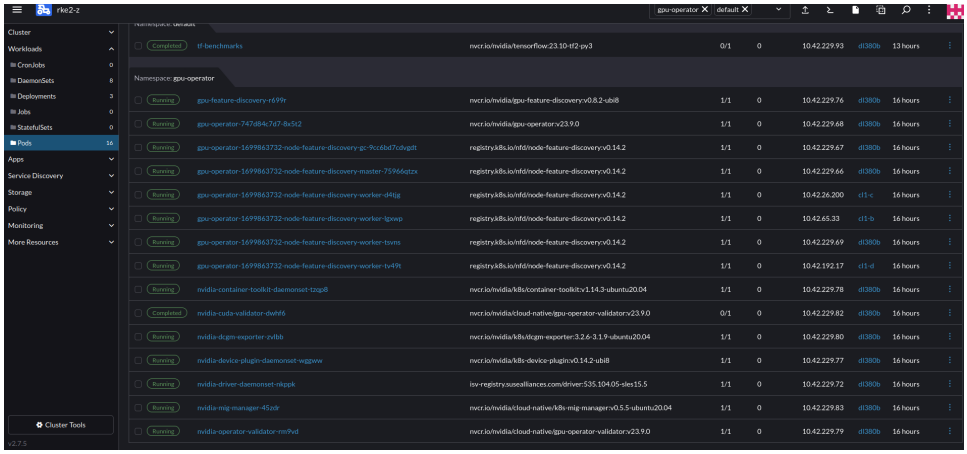


In this RKE2 setup we have 3 SLE15.5 based nodes with all-roles (controle-plane, etcd, Master)

and 1 SLE15.5 worker node with H100 GPU installed.

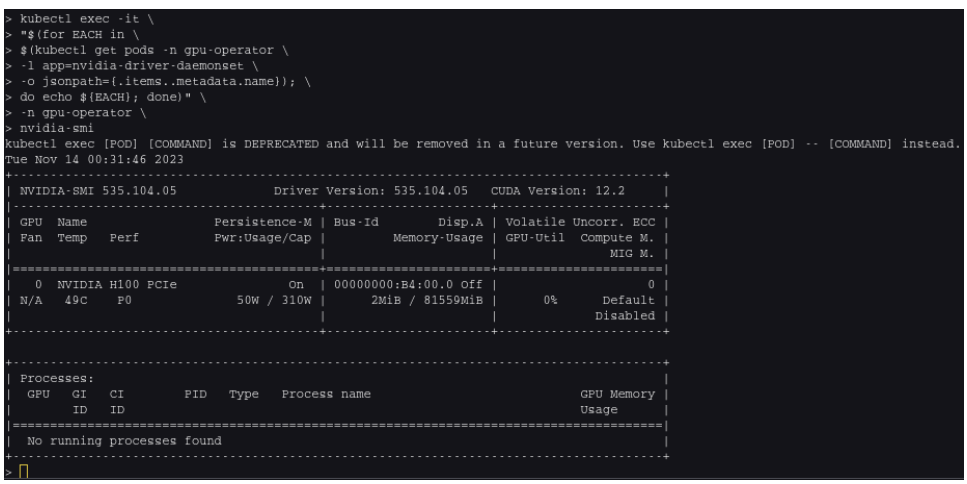
Validate that gpu-operator deployed:

Click Workload > Pods



From Kubectl shell execute the following:

```
kubectl exec -it \
"$(for EACH in \
$(kubectl get pods -n gpu-operator \
-l app=nvidia-driver-daemonset \
-o jsonpath={.items..metadata.name}); \
do echo ${EACH}; done)" \
-n gpu-operator \
nvidia-smi
```



```
> kubectl exec -it \
> "$(for EACH in \
> $(kubectl get pods -n gpu-operator \
> -l app=nvidia-driver-daemonset \
> -o jsonpath={.items..metadata.name}); \
> do echo ${EACH}; done)" \
> -n gpu-operator \
> nvidia-smi
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
Tue Nov 14 00:31:46 2023
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 535.104.05             Driver Version: 535.104.05   CUDA Version: 12.2     |
|-------------------------------------+----------------------+----------------------+
| 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 H100 PCIe               On  | 00000000:B4:00.0 Off |                    0 |
| N/A   49C    P0              50W / 310W |      2MiB / 81559MiB |      0%      Default |
|                                         |                      |             Disabled |
+-------------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                                  |
|  GPU   GI   CI        PID   Type   Process name                  GPU Memory |
|        ID   ID                                                   Usage      |
|=============================================================================|
|  No running processes found                                                 |
+-----------------------------------------------------------------------------+
> 
```

No workload is listed in the above screenshot.

Generate some test workload >

Deploy tf-benchmarks.yaml file with

kubectl apply -f tf-benchmarks.yaml

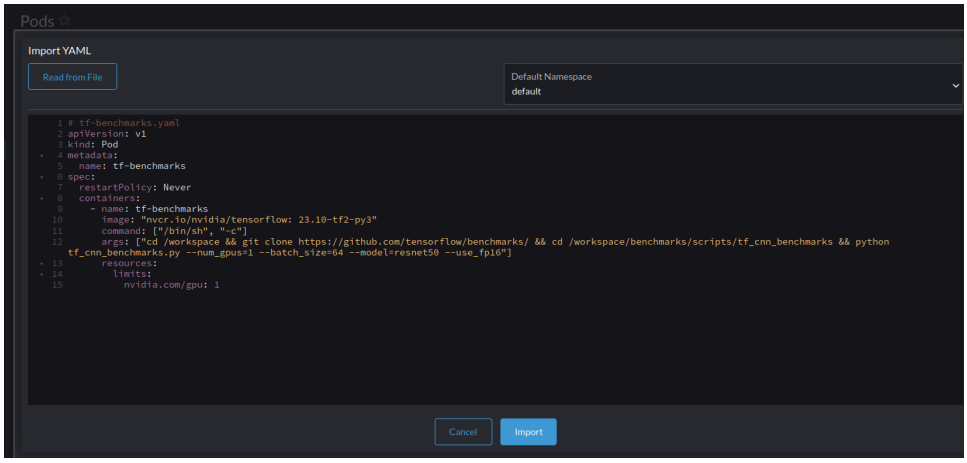
from your master node.

Or from the Rancher Dashboard click <Import Yaml> and paste the following:

==========

```
 # tf-benchmarks.yaml
apiVersion: v1
kind: Pod
metadata:
  name: tf-benchmarks
spec:
  restartPolicy: Never
  containers:
    - name: tf-benchmarks
      image: "nvcr.io/nvidia/tensorflow:23.10-tf2-py3"
      command: ["/bin/sh", "-c"]
      args: ["cd /workspace && git clone https://github.com/tensorflow/benchmarks/ && cd
/workspace/benchmarks/scripts/tf_cnn_benchmarks && python tf_cnn_benchmarks.py --num_gpus=1
--batch_size=64 --model=resnet50 --use_fp16"]
      resources:
        limits:
          nvidia.com/gpu: 1
```

========== ref > https://developer.nvidia.com/blog/getting-kubernetes-ready-for-the-a100-gpu-with-multi-instance-gpu/ can be used for diff. Nvidia tests including MIG strategy which we used with DGX.



Click import which will create tf-benchmark pod.

While pod is in the training mode, run the same nvidi-smi command to validate the workload:

(You'll have about 10 sec to catch the output)

```
kubectl exec -it \
"$(for EACH in \
$(kubectl get pods -n gpu-operator \
-l app=nvidia-driver-daemonset \
-o jsonpath={.items..metadata.name}); \
do echo ${EACH}; done)" \
-n gpu-operator \
nvidia-smi
```

```
> kubectl exec -it "$(for EACH in \
$(kubectl get pods -n gpu-operator \
-l app=nvidia-driver-daemonset \
-o jsonpath={.items..metadata.name}); \
do echo ${EACH}; done)" -n gpu-operator nvidia-smi
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
Tue Nov 14 00:56:01 2023
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 535.104.05             Driver Version: 535.104.05   CUDA Version: 12.2     |
|-----------------------------------------+----------------------+----------------------+
| 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 H100 PCIe               On  | 00000000:B4:00.0 Off |                    0 |
| N/A   55C    P0             208W / 310W |  79583MiB / 81559MiB |     83%      Default |
|                                         |                      |             Disabled |
+-----------------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                            GPU Memory |
|        ID   ID                                                             Usage      |
|=========================================================================================|
|    0   N/A  N/A     90376      C   python                                   79574MiB |
+-----------------------------------------------------------------------------------------+
```

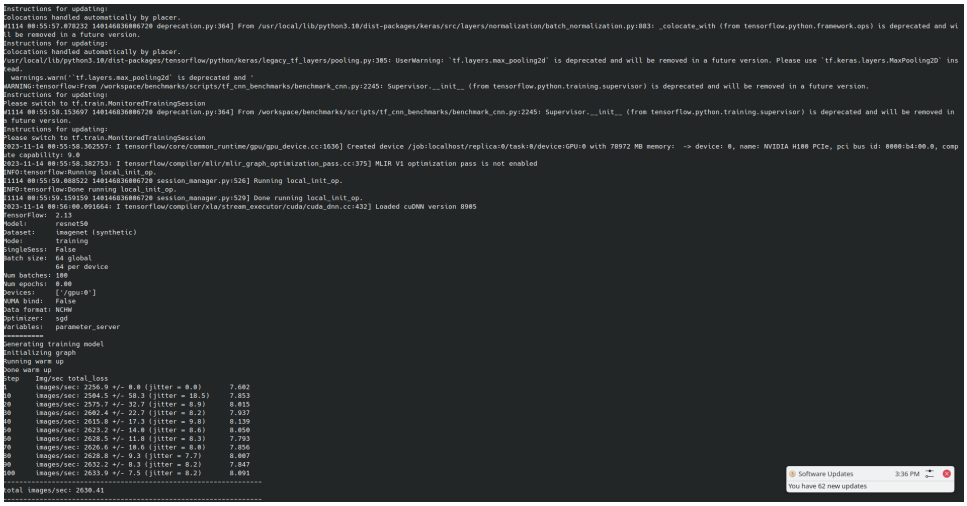
```
> kubectl exec -it "$(for EACH in \
$(kubectl get pods -n gpu-operator \
-l app=nvidia-driver-daemonset \
-o jsonpath={.items..metadata.name}); \
do echo ${EACH}; done)" -n gpu-operator nvidia-smi
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
Tue Nov 14 00:56:02 2023
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 535.104.05             Driver Version: 535.104.05   CUDA Version: 12.2     |
|-----------------------------------------+----------------------+----------------------+
| 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 H100 PCIe               On  | 00000000:B4:00.0 Off |                    0 |
| N/A   56C    P0             271W / 310W |  79583MiB / 81559MiB |     92%      Default |
|                                         |                      |             Disabled |
+-----------------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                            GPU Memory |
|        ID   ID                                                             Usage      |
|=========================================================================================|
|    0   N/A  N/A     90376      C   python                                   79574MiB |
+-----------------------------------------------------------------------------------------+
```

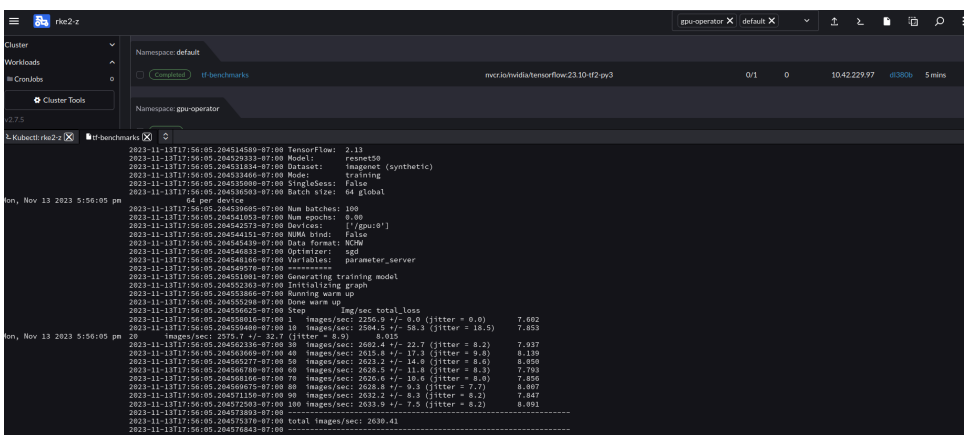
Also, you can check logs from tf-benchmarks pod

kubectl logs tf-benchmarks

```
Kubectl: rke2-z
I1114 00:55:59.159159 140146836006720 session_manager.py:529] Done running local_init_op.
2023-11-14 00:56:00.091664: I tensorflow/compiler/xla/stream_executor/cuda/cuda_dnn.cc:432] Loaded cuDNN version 8905
TensorFlow:  2.13
Model:       resnet50
Dataset:     imagenet (synthetic)
Mode:        training
SingleSess:  False
Batch size:  64 global
             64 per device
Num batches: 100
Num epochs:  0.00
Devices:     ['/gpu:0']
NUMA bind:   False
Data format: NCHW
Optimizer:   sgd
Variables:   parameter_server
==========
Generating training model
Initializing graph
Running warm up
Done warm up
Step    Img/sec total_loss
1       images/sec: 2256.9 +/- 0.0 (jitter = 0.0)       7.602
10      images/sec: 2504.5 +/- 58.3 (jitter = 18.5)     7.853
20      images/sec: 2575.7 +/- 32.7 (jitter = 8.9)      8.015
30      images/sec: 2602.4 +/- 22.7 (jitter = 8.2)      7.937
40      images/sec: 2615.8 +/- 17.3 (jitter = 9.8)      8.139
50      images/sec: 2623.2 +/- 14.0 (jitter = 8.6)      8.050
60      images/sec: 2628.5 +/- 11.8 (jitter = 8.3)      7.793
70      images/sec: 2626.6 +/- 10.6 (jitter = 8.0)      7.856
80      images/sec: 2628.8 +/- 9.3 (jitter = 7.7)       8.007
90      images/sec: 2632.2 +/- 8.3 (jitter = 8.2)       7.847
100     images/sec: 2633.9 +/- 7.5 (jitter = 8.2)       8.091
----------------------------------------------------------------
total images/sec: 2630.41
----------------------------------------------------------------
```



Or simply click on pod's View Logs >



==========

If you want to rerun the test, simply re-deploy pod again.

To view GPU metrics modify Prometheus yaml in rancher-monitoring during Rancher-Monitoring installation (already done):

==========

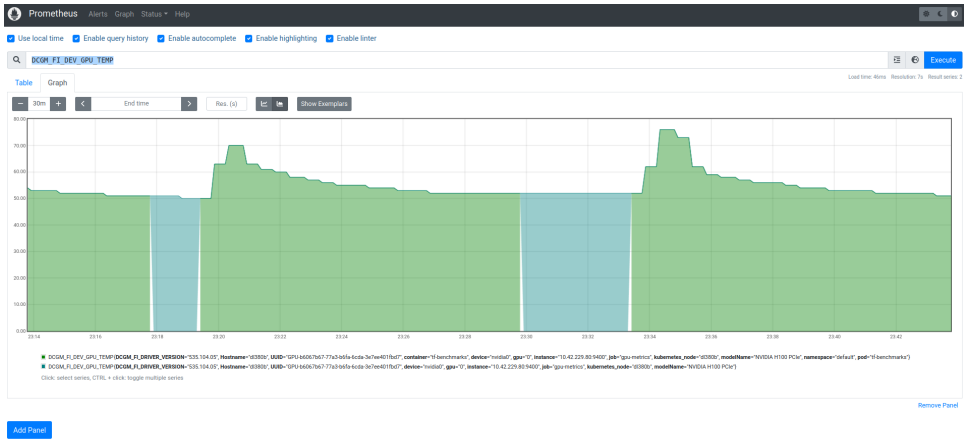
prometheus:

  prometheusSpec:

```
serviceMonitorSelectorNilUsesHelmValues: false
additionalScrapeConfigs:
- job_name: gpu-metrics
  scrape_interval: 1s
  metrics_path: /metrics
  scheme: http
  kubernetes_sd_configs:
  - role: endpoints
    namespaces:
      names:
      - gpu-operator
  relabel_configs:
  - source_labels: [__meta_kubernetes_pod_node_name]
    action: replace
    target_label: kubernetes_node
```

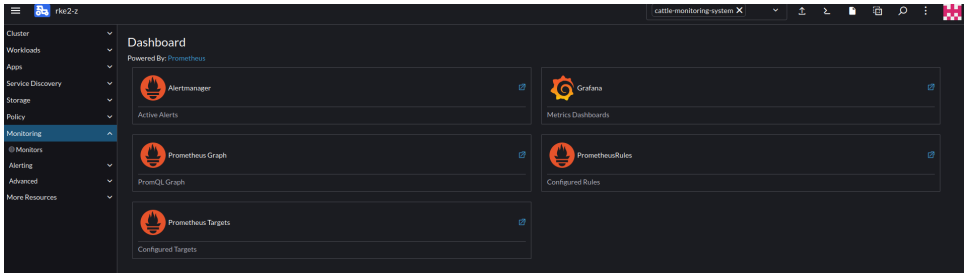
==========

In Prometheus panel enter DCGM_FI_DEV_GPU_TEMP



Import NVIDIA DCGM Exporter Dashboard from Grafana (already done)

Open Grafana >



Search for NVIDIA DCGM dashboard

==========

Diff. test values will give you diff numbers.

For ex. changing arguments can increase the GPU utilization:

…….....

python tf_cnn_benchmarks.py --num_gpus=1 --batch_size=1024 --model=resnet50

--variable_update=parameter_server --use_fp16

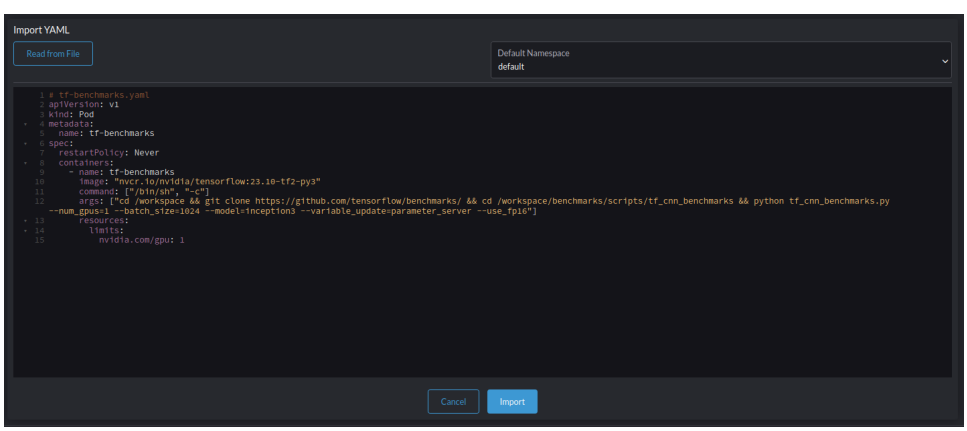
…….....

```
==========
Generating training model
Initializing graph
Running warm up
Done warm up
Step    Img/sec total_loss
1       images/sec: 3738.7 +/- 0.0 (jitter = 0.0)       7.853
10      images/sec: 3733.4 +/- 4.1 (jitter = 21.8)      7.844
20      images/sec: 3734.9 +/- 2.7 (jitter = 16.2)      7.756
30      images/sec: 3734.4 +/- 2.0 (jitter = 14.2)      7.744
40      images/sec: 3732.7 +/- 1.8 (jitter = 14.4)      7.694
50      images/sec: 3732.3 +/- 1.6 (jitter = 13.8)      7.660
60      images/sec: 3730.9 +/- 1.5 (jitter = 13.4)      7.658
70      images/sec: 3730.0 +/- 1.4 (jitter = 13.7)      7.589
80      images/sec: 3727.8 +/- 1.4 (jitter = 15.8)      7.580
90      images/sec: 3725.6 +/- 1.5 (jitter = 15.9)      7.538
100     images/sec: 3723.4 +/- 1.6 (jitter = 18.4)      7.532
----------------------------------------------------------------
total images/sec: 3722.94
----------------------------------------------------------------
```

```
cl1-b:/etc/rancher/rke2 # kubectl exec -it "$(for EACH in \
$(kubectl get pods -n gpu-operator \
-l app=nvidia-driver-daemonset \
-o jsonpath={.items..metadata.name}); \
do echo ${EACH}; done)" -n gpu-operator nvidia-smi
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
Tue Nov 14 06:19:22 2023
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 535.104.05             Driver Version: 535.104.05   CUDA Version: 12.2     |
|-----------------------------------------+----------------------+----------------------+
| 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 H100 PCIe               On  | 00000000:B4:00.0 Off |                    0 |
| N/A   66C    P0             304W / 310W |  79583MiB / 81559MiB |     99%      Default |
|                                         |                      |             Disabled |
+-----------------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                            GPU Memory |
|        ID   ID                                                             Usage      |
|=========================================================================================|
|    0   N/A  N/A     84759      C   python                                     79574MiB |
+-----------------------------------------------------------------------------------------+
```

Another example:




```
cl1-b:/etc/rancher/rke2 # kubectl exec -it "$(for EACH in \
$(kubectl get pods -n gpu-operator \
-l app=nvidia-driver-daemonset \
-o jsonpath={.items..metadata.name}); \
do echo ${EACH}; done)" -n gpu-operator nvidia-smi
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
Tue Nov 14 06:33:24 2023
+-----------------------------------------------------------------------------+
| NVIDIA-SMI 535.104.05             Driver Version: 535.104.05   CUDA Version: 12.2     |
|-------------------------------------+----------------------+----------------------+
| 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 H100 PCIe               On  | 00000000:B4:00.0 Off |                    0 |
| N/A   67C    P0             302W / 310W |  79583MiB / 81559MiB |    100%      Default |
|                                         |                      |             Disabled |
+-------------------------------------+----------------------+----------------------+

+-----------------------------------------------------------------------------+
| Processes:                                                                  |
|  GPU   GI   CI        PID   Type   Process name                  GPU Memory |
|        ID   ID                                                   Usage      |
|=============================================================================|
|    0   N/A  N/A     92335      C   python                           79574MiB |
+-----------------------------------------------------------------------------+
```

More tf_cnn_benchmarks tests are available at > https://github.com/tensorflow/benchmarks/tree/master/scripts/tf_cnn_benchmarks