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## NVIDIA GPU Operator Setup with Grafana and Prometheus

### Overview

Currently, two Kubernetes clusters are deployed: **p1** running Prometheus and **c2** running NVIDIA GPU Operator. Long-term, these may be consolidated into a single cluster for simplicity.

### Cluster Configuration

Two Kubernetes clusters are running:

- **P1 cluster:** Runs Grafana and Prometheus in the `monitoring` namespace
- **P2 cluster:** Has Grafana-Prometheus in the `monitoring` namespace

The P1 cluster runs Grafana/Prometheus with the main prometheus-grafana service set up as NodePort on port 31600. Launch a web browser to `p1-worker-vm:31600`; the default login is `admin/prom-operator`.

### P1 Cluster Details

```
wsl=> k config current-context
p1-admin@p1.grafana

wsl=> k get node
NAME                                STATUS    ROLES    AGE    VERSION
p1-master-vm.hst.enablement.local  Ready    control-plane  79d    v1.33.1
p1-worker-vm.hst.enablement.local   Ready    <none>       79d    v1.33.1
hjna@HSTHJMA02:~
```

  

```
wsl=> k get svc -n monitoring
NAME                                TYPE        CLUSTER-IP    EXTERNAL-IP    PORT(S)
```

NAME	AGE	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)
alertmanager-operated		ClusterIP	None	<none>	9093/
TCP,9094/TCP,9094/UDP	54d				
prometheus-operated		ClusterIP	None	<none>	9090/
TCP	54d				
test-prometheus-grafana		NodePort	10.97.92.135	<none>	
80:31600/TCP	54d				
test-prometheus-kube-prometheus-alertmanager		ClusterIP	10.100.1.114	<none>	9093/
TCP,8080/TCP	54d				
test-prometheus-kube-prometheus-operator		ClusterIP	10.100.184.136	<none>	443/TCP
	54d				
test-prometheus-kube-prometheus-prometheus		ClusterIP	10.107.215.146	<none>	9090/
TCP,8080/TCP	54d				
test-prometheus-kube-state-metrics		ClusterIP	10.101.113.18	<none>	8080/
TCP	54d				
test-prometheus-prometheus-node-exporter		ClusterIP	10.100.132.103	<none>	9100/
TCP	54d				

```
wsl=> curl 10.16.160.42:31600
```

```
<a href="/login">Found</a>.
```

## Prometheus Helm Configuration

In the P1 cluster, Grafana/Prometheus was set up using Helm:

```
wsl=> helm list -A --filter 'prometheus'
NAME                NAMESPACE      REVISION    UPDATED
STATUS             CHART           APP VERSION
test-prometheus     monitoring      3           2025-07-22 17:11:52.125453 -0700 MST
deployed           kube-prometheus-stack-75.4.0
v0.83.0
hjma@HSTHJMA02:~

wsl=> helm -n monitoring get values test-prometheus --revision 3
USER-SUPPLIED VALUES:
prometheus:
  prometheusSpec:
    additionalScrapeConfigs:
      - job_name: c2-dcgm-exporter
        static_configs:
          - targets:
              - 10.16.160.54:30639
              - 10.16.160.54:30639
hjma@HSTHJMA02:~
wsl=> helm -n monitoring get values test-prometheus --revision 2
USER-SUPPLIED VALUES:
prometheus:
  prometheusSpec:
    additionalScrapeConfigs:
      - job_name: c2-dcgm-exporter
        static_configs:
          - targets:
              - 10.16.160.54:31065
              - 10.16.160.55:31065
hjma@HSTHJMA02:~
wsl=> helm -n monitoring get values test-prometheus --revision 1
USER-SUPPLIED VALUES:
null
hjma@HSTHJMA02:~
```

## C2 Cluster Configuration

The C2 cluster has the GPU Operator in the `gpu-operator` namespace.

## DCGM Exporter Overview

The NVIDIA GPU Operator Helm chart deploys a DCGM (Data Center GPU Manager) exporter by default, but there are important nuances:

- The DCGM exporter Pod will be created automatically when the operator detects a node with an NVIDIA GPU and the `dcgm-exporter` component is enabled in its values.

- In the stock gpu-operator Helm chart from NVIDIA's repo, the DCGM exporter is enabled by default (`dcgmExporter.enabled: true`).

However:

1. ServiceMonitor is not enabled by default.
  - This means Prometheus won't automatically scrape the DCGM exporter unless you either:
    - Enable the ServiceMonitor (`dcgmExporter.serviceMonitor.enabled: true`),  
or
    - Manually define a scrape config in Prometheus.
2. No GPUs → No exporter pods
  - If the GPU Operator is installed into a cluster without GPU-capable nodes, the DaemonSet for dcgm-exporter may not schedule any pods.

## ServiceMonitor Overview

A ServiceMonitor is not a built-in Kubernetes object like a Pod, Deployment, or Service. It's a Custom Resource Definition (CRD) that comes from the Prometheus Operator (or kube-prometheus-stack Helm chart).

### How it works:

- You first deploy Prometheus Operator (usually via kube-prometheus-stack Helm chart).
- The Prometheus Operator introduces new CRDs, including:
  - ServiceMonitor
  - PodMonitor
  - PrometheusRule
- Prometheus Operator watches for ServiceMonitor objects and dynamically updates Prometheus' scrape configuration to match them.

### For NVIDIA GPU Operator:

- If set to true, it will create a ServiceMonitor for the DCGM exporter so Prometheus can scrape GPU metrics automatically.
- If you don't have Prometheus Operator installed, creating a ServiceMonitor will do nothing—because only the Prometheus Operator knows how to use it.

## C2 Cluster Details

The DCGM exporter typically uses port 9400.

```
wsl=> k config use-context c2-admin@c2.gpu
Switched to context "c2-admin@c2.gpu".
hjma@HSTHJMA02:~

wsl=> k get svc -n gpu-operator
NAME                                TYPE             CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
gpu-operator                        ClusterIP         10.233.44.80     <none>           8080/TCP         23d
nvidia-dcgm-exporter               ClusterIP         10.233.15.59     <none>           9400/TCP         23d
hjma@HSTHJMA02:~

wsl=> helm list -A
NAME                                NAMESPACE        REVISION        UPDATED           CHART              APP VERSION
gpu-operator-1753140595            gpu-operator      1               2025-07-21 16:30:01.929686717 -0700
MST deployed                       gpu-operator-v25.3.0 v25.3.0
wsl=> helm show values nvidia/gpu-operator | grep -A20 dcgmExporter:
dcgmExporter:
  enabled: true
  repository: nvcr.io/nvidia/k8s
  image: dcgm-exporter
  version: 4.2.3-4.1.3-ubuntu22.04
  imagePullPolicy: IfNotPresent
  env:
    - name: DCGM_EXPORTER_LISTEN
      value: ":9400"
    - name: DCGM_EXPORTER_KUBERNETES
      value: "true"
    - name: DCGM_EXPORTER_COLLECTORS
      value: "/etc/dcgm-exporter/dcp-metrics-included.csv"
  resources: {}
  service:
    internalTrafficPolicy: Cluster
  serviceMonitor:
    enabled: false
    interval: 15s
    honorLabels: false
    additionalLabels: {}
```

## Making C2 DCGM Exporter Service Available to P1 Prometheus

We can change the `dcgm-exporter` service from the default `ClusterIP` to `NodePort`. If we patch Kubernetes using `kubectl`, the change will not be persistent, as Helm values remain at their defaults. The next time you upgrade the `gpu-operator` Helm chart, the service will revert to `ClusterIP`. We need to modify Helm values to make the change persistent.

[!NOTE] After hours of investigation, Helm does not have a value to lock the `NodePort` port number. It can only define the type as `NodePort` and the `internalTrafficPolicy` field. Attempting to define `NodePort 39400` to lock the port (preventing changes after restart or chart upgrade) resulted in “field not supported” errors. This limitation led to the decision to install

Prometheus on the C2 cluster to avoid this complexity.

[!TIP] This is a useful tip or suggestion.

[!IMPORTANT] This is important information that users should not miss.

[!WARNING] This is a warning about a potential issue or a caution.