



## Exercise 4.1: Working with CPU and Memory Constraints

### Overview

We will continue working with our cluster, which we built in the previous lab. We will work with `resource limits`, more with `namespaces` and then a complex deployment which you can explore to further understand the architecture and relationships.

Use **SSH** or **PuTTY** to connect to the nodes you installed in the previous exercise. We will deploy an application called **stress** inside a container, and then use `resource limits` to constrain the resources the application has access to use.

1. Use a container called `stress`, which we will name `hog`, to generate load. Verify you have a container running.

```
student@lfs458-node-1a0a:~$ kubectl create deployment hog --image vish/stress
deployment.apps/hog created
```

```
student@lfs458-node-1a0a:~$ kubectl get deployments
```

NAME	READY	UP-TO-DATE	AVAILABLE	AGE
hog	1/1	1	1	13s

2. Use the `describe` argument to view details, then view the output in YAML format. Note there are no settings limiting resource usage. Instead, there are empty curly brackets.

```
student@lfs458-node-1a0a:~$ kubectl describe deployment hog
```

```
Name:                hog
Namespace:           default
CreationTimestamp:   Tue, 08 Jan 2019 17:01:54 +0000
Labels:              app=hog
Annotations:         deployment.kubernetes.io/revision: 1
<output_omitted>
```

```
student@lfs458-node-1a0a:~$ kubectl get deployment hog -o yaml
```

```
apiVersion: extensions/v1beta1
kind: Deployment
Metadata:
```

```
<output_omitted>
```

```
  template:
    metadata:
      creationTimestamp: null
      labels:
        app: hog
    spec:
      containers:
        - image: vish/stress
          imagePullPolicy: Always
          name: stress
          resources: {}
          terminationMessagePath: /dev/termination-log
<output_omitted>
```

3. We will use the YAML output to create our own configuration file. The `--export` option can be useful to not include unique parameters.

```
student@lfs458-node-1a0a:~$ kubectl get deployment hog \
--export -o yaml > hog.yaml
```

4. If you did not use the `--export` option we will need to remove the status output, creationTimestamp and other settings, as we don't want to set unique generated parameters. We will also add in memory limits found below.

```
student@lfs458-node-1a0a:~$ vim hog.yaml
```

**YAML**

hog.yaml

```
1  ....
2      imagePullPolicy: Always
3      name: hog
4      resources:                # Edit to remove {}
5          limits:                # Add these 4 lines
6              memory: "4Gi"
7          requests:
8              memory: "2500Mi"
9      terminationMessagePath: /dev/termination-log
10     terminationMessagePolicy: File
11  ....
```

5. Replace the deployment using the newly edited file.

```
student@lfs458-node-1a0a:~$ kubectl replace -f hog.yaml
deployment.extensions/hog replaced
```

6. Verify the change has been made. The deployment should now show resource limits.

```
student@lfs458-node-1a0a:~$ kubectl get deployment hog -o yaml
....
resources:
  limits:
    memory: 4Gi
  requests:
    memory: 2500Mi
  terminationMessagePath: /dev/termination-log
....
```

7. View the `stdio` of the `hog` container. Note how much memory has been allocated.

```
student@lfs458-node-1a0a:~$ kubectl get po
NAME                                READY    STATUS    RESTARTS   AGE
hog-64cbfcc7cf-lwq66               1/1      Running   0           2m

student@lfs458-node-1a0a:~$ kubectl logs hog-64cbfcc7cf-lwq66
I1102 16:16:42.638972      1 main.go:26] Allocating "0" memory, in
"4Ki" chunks, with a 1ms sleep between allocations
I1102 16:16:42.639064      1 main.go:29] Allocated "0" memory
```

8. Open a second and third terminal to access both master and second nodes. Run **top** to view resource usage. You should not see unusual resource usage at this point. The **dockerd** and **top** processes should be using about the same amount of resources. The **stress** command should not be using enough resources to show up.

9. Edit the `hog` configuration file and add arguments for **stress** to consume CPU and memory. The `args:` entry should be spaces to the same indent as `resources:`.

```
student@lfs458-node-1a0a:~$ vim hog.yaml
```



hog.yaml

```

1  ....
2      resources:
3          limits:
4              cpu: "1"
5              memory: "4Gi"
6          requests:
7              cpu: "0.5"
8              memory: "500Mi"
9      args:
10     - -cpus
11     - "2"
12     - -mem-total
13     - "950Mi"
14     - -mem-alloc-size
15     - "100Mi"
16     - -mem-alloc-sleep
17     - "1s"
18  ....

```

10. Delete and recreate the deployment. You should see increased CPU usage almost immediately and memory allocation happen in 100M chunks allocated to the **stress** program via the running **top** command. Check both nodes as the container could be deployed to either.

```

student@lfs458-node-1a0a:~$ kubectl delete deployment hog
deployment.extensions "hog" deleted

```

```

student@lfs458-node-1a0a:~$ kubectl create -f hog.yaml
deployment.extensions/hog created

```



### Only if top does not show high usage

Should the resources not show increased use, there may have been an issue inside of the container. Kubernetes may show it as running, but the actual workload has failed. Or the container may have failed; for example if you were missing a parameter the container may panic.

```

student@lfs458-node-1a0a:~$ kubectl get pod

```

NAME	READY	STATUS	RESTARTS	AGE
hog-1985182137-5bz2w	0/1	Error	1	5s

```

student@lfs458-node-1a0a:~$ kubectl logs hog-1985182137-5bz2w

```

```

panic: cannot parse '150mi': unable to parse quantity's suffix

```

```

goroutine 1 [running]:

```

```

panic(0x5ff9a0, 0xc820014cb0)

```

```

/usr/local/go/src/runtime/panic.go:481 +0x3e6

```

```

k8s.io/kubernetes/pkg/api/resource.MustParse(0x7ffe460c0e69, 0x5, 0x0, 0x0, 0x0, 0x0, 0x0, 0x0, 0x0)

```

```

/usr/local/google/home/vishnuk/go/src/k8s.io/kubernetes/pkg/api/resource/quantity.go:134 +0x287

```

```

main.main()

```

```

/usr/local/google/home/vishnuk/go/src/github.com/vishhh/stress/main.go:24 +0x43

```

Here is an example of an improper parameter. The container is running, but not allocating memory. It should show the usage requested from the YAML file.

```

student@lfs458-node-1a0a:~$ kubectl get po

```

NAME	READY	STATUS	RESTARTS	AGE
hog-1603763060-x3vnn	1/1	Running	0	8s



```
student@lfs458-node-1a0a:~$ kubectl logs hog-1603763060-x3vnn
I0927 21:09:23.514921      1 main.go:26] Allocating "0" memory, in "4ki" chunks, with a 1ms sleep \
                        between allocations
I0927 21:09:23.514984      1 main.go:39] Spawning a thread to consume CPU
I0927 21:09:23.514991      1 main.go:39] Spawning a thread to consume CPU
I0927 21:09:23.514997      1 main.go:29] Allocated "0" memory
```