

Kubernetes - Workshop

This is just an intro, which tights to the presentation of Modern Application. For this workshop we will leverage kind.

Kind is a tool for running local Kubernetes clusters using Docker container “nodes”. kind was primarily designed for testing Kubernetes itself, but may be used for local development or CI.

We will first build a simple cluster with a specific name. If you omit the flag `--name` default name will be kind. As we get a little more familiar with kind cli, keep in mind that the other tool we could have selected was minikube, however, kind is newer and allows you to run a small kubernetes cluster for testing and learning purposes.

Shortcut your typing

```
echo "alias k=kubectl" >> ~/.bashrc
echo "kubectl completion bash | sed s/kubectl/k/g" >> ~/.bashrc
. ~/.bashrc
```

Understand how to use help with kubectl. Each main subcommand has a subset of help. The main will be `kubectl -h` or `kubectl --help`. Of course, this workshop is not going through each of the commands, that's something you can explore in your own. We will however cover many of them.

Verbose and debug mode. Depending on what you are looking for, kubectl can help to display the API calls. Test it by starting with level 6 and then by checking the level 7, and debug 8 to see the different outputs.

You can also try debug level 9 for more verbosity and also level 10 if you really want to see all call, even it's not listed on this page and it will have a lot of data! [Kubernetes CheatSheet](#)

```
k get -v6 pods
```

Show Merged kubeconfig settings.

```
k config view
```

Use multiple kubeconfig files at the same time and view merged config

```
KUBECONFIG=~/.kube/config:~/.kube/kubconfig2
```

```
k config view
```

Display list of contexts

```
k config get-contexts
```

Display the current-context

```
k config current-context
```

Set the default context to my-cluster-name, the name can be showed with the command above.

```
k config use-context <<cluster-name>>
k config set-context kind-remo
k config -h <to get some additional help>
```

EXAMPLE: (in my case I have two running, KIND and Minikube, and it shows you which is the default config)

```
k config get-contexts
CURRENT  NAME      CLUSTER  AUTHINFO  NAMESPACE
*        kind-kind kind-kind kind-kind
        minikube minikube minikube  default
```

Add a new user to your kubeconf that supports basic auth. We use this example in our Agility Lab, which was offered the last couple of years. [CIS Lab](#)

```
k config set-credentials kubeuser/foo.kubernetes.com --username=kubeuser
--password=kubepassword
```

Permanently save the namespace for all subsequent kubectl commands in that context.

```
k config set-context --current --namespace=ciao
```

Set a context utilizing a specific username and namespace.

```
k config set-context gce --user=cluster-admin --namespace=ciao \
&& k config use-context gce
```

This unsets the config for the user ciao `k config unset users.ciao`

Single Cluster

First let's evaluate kind's help

```
kind --help
kind creates and manages local Kubernetes clusters using Docker container 'nodes'
```

Usage:

```
kind [command]
```

Available Commands:

build	Build one of [node-image]
completion	Output shell completion code for the specified shell (bash, zsh or fish)
create	Creates one of [cluster]
delete	Deletes one of [cluster]
export	Exports one of [kubeconfig, logs]
get	Gets one of [clusters, nodes, kubeconfig]
help	Help about any command
load	Loads images into nodes
version	Prints the kind CLI version

Flags:

-h, --help	help for kind
--loglevel string	DEPRECATED: see -v instead
-q, --quiet	silence all stderr output
-v, --verbosity int32	info log verbosity
--version	version for kind

Use "kind [command] --help" for more information about a command.

```
kind create cluster --name workshop
```

OUTPUT:

```
❯ kind create cluster --name workshop
Creating cluster "workshop" ...
❯ Ensuring node image (kindest/node:v1.20.2) ❯
❯ Preparing nodes ❯
❯ Writing configuration ❯
❯ Starting control-plane ☐☐
❯ Installing CNI ❯
❯ Installing StorageClass ❯
Set kubectl context to "kind-workshop"
You can now use your cluster with:

k cluster-info --context kind-workshop

Have a nice day! ❯
```

Using kind command to verify we have a cluster

```
❏ kind get clusters
```

OUTPUT:

```
❏ kind get clusters
workshop
```

Check nodes

```
❏ k get nodes
```

OUTPUT: We can see the workshop name for the control plane.

```
❏ k get nodes
```

NAME	STATUS	ROLES	AGE	VERSION
workshop-control-plane	Ready	control-plane,master	11m	v1.20.2

We will use the describe subcommand to see the details of the node.

```
❏ k describe no <<your node name>>
```

Example:

```
❏ k describe no workshop-control-plane
```

NOTE the option no is short for nodes.

OUTPUT:

```
❏ k describe no workshop-control-plane
Name:                workshop-control-plane
Roles:               control-plane,master
Labels:              beta.kubernetes.io/arch=amd64
                    beta.kubernetes.io/os=linux
                    kubernetes.io/arch=amd64
                    kubernetes.io/hostname=workshop-control-plane
                    kubernetes.io/os=linux
                    node-role.kubernetes.io/control-plane=
                    node-role.kubernetes.io/master=
Annotations:         kubeadm.alpha.kubernetes.io/cri-socket:
                    unix:///run/containerd/containerd.sock
                    node.alpha.kubernetes.io/ttl: 0
                    volumes.kubernetes.io/controller-managed-attach-detach: true
```

CreationTimestamp: Wed, 12 May 2021 20:44:18 -0700

Taints: <none>

Unschedulable: false

Lease:

HolderIdentity: workshop-control-plane

AcquireTime: <unset>

RenewTime: Wed, 12 May 2021 21:09:02 -0700

Conditions:

Type	Status	LastHeartbeatTime	LastTransitionTime
Reason		Message	
----	-----	-----	-----
MemoryPressure	False	Wed, 12 May 2021 21:05:02 -0700	Wed, 12 May 2021 20:44:17 -0700
KubeletHasSufficientMemory		kubelet has sufficient memory available	
DiskPressure	False	Wed, 12 May 2021 21:05:02 -0700	Wed, 12 May 2021 20:44:17 -0700
KubeletHasNoDiskPressure		kubelet has no disk pressure	
PIDPressure	False	Wed, 12 May 2021 21:05:02 -0700	Wed, 12 May 2021 20:44:17 -0700
KubeletHasSufficientPID		kubelet has sufficient PID available	
Ready	True	Wed, 12 May 2021 21:05:02 -0700	Wed, 12 May 2021 20:45:02 -0700
KubeletReady		kubelet is posting ready status	

Addresses:

InternalIP: 172.18.0.2

Hostname: workshop-control-plane

Capacity:

cpu: 8
ephemeral-storage: 61255492Ki
hugepages-1Gi: 0
hugepages-2Mi: 0
memory: 2034536Ki
pods: 110

Allocatable:

cpu: 8
ephemeral-storage: 61255492Ki
hugepages-1Gi: 0
hugepages-2Mi: 0
memory: 2034536Ki
pods: 110

System Info:

Machine ID: a7799064a9e74d6cb45448b4c172f5e0
System UUID: ff810c9a-bbad-4497-8ac1-f369ac65ce6e
Boot ID: fb696cfd-2560-4842-9d50-7b84f86326a9
Kernel Version: 5.10.25-linuxkit
OS Image: Ubuntu 20.10
Operating System: linux
Architecture: amd64
Container Runtime Version: containerd://1.4.0-106-gce4439a8
Kubelet Version: v1.20.2
Kube-Proxy Version: v1.20.2

PodCIDR: 10.244.0.0/24

PodCIDRs: 10.244.0.0/24

ProviderID: kind://docker/workshop/workshop-control-plane

```

Non-terminated Pods:          (9 in total)
  Namespace                  Name                      CPU
Requests  CPU Limits  Memory Requests  Memory Limits  AGE
-----
  kube-system                coredns-74ff55c5b-p2bch          100m
(1%)      0 (0%)      70Mi (3%)      170Mi (8%)      24m
  kube-system                coredns-74ff55c5b-wk5d5          100m
(1%)      0 (0%)      70Mi (3%)      170Mi (8%)      24m
  kube-system                etcd-workshop-control-plane      100m
(1%)      0 (0%)      100Mi (5%)      0 (0%)          24m
  kube-system                kindnet-hfj8j                    100m
(1%)      100m (1%)    50Mi (2%)      50Mi (2%)      24m
  kube-system                kube-apiserver-workshop-control-plane 250m
(3%)      0 (0%)      0 (0%)          0 (0%)          24m
  kube-system                kube-controller-manager-workshop-control-plane 200m
(2%)      0 (0%)      0 (0%)          0 (0%)          24m
  kube-system                kube-proxy-tqt8q                  0 (0%)
0 (0%)      0 (0%)      0 (0%)          24m
  kube-system                kube-scheduler-workshop-control-plane 100m
(1%)      0 (0%)      0 (0%)          0 (0%)          24m
  local-path-storage         local-path-provisioner-78776bfc44-fg2hn 0 (0%)
0 (0%)      0 (0%)      0 (0%)          24m

Allocated resources:
(Total limits may be over 100 percent, i.e., overcommitted.)
Resource           Requests           Limits
-----
cpu                 950m (11%)        100m (1%)
memory              290Mi (14%)        390Mi (19%)
ephemeral-storage   100Mi (0%)         0 (0%)
hugepages-1Gi       0 (0%)             0 (0%)
hugepages-2Mi       0 (0%)             0 (0%)

Events:
Type      Reason                      Age              From           Message
-----
Normal    NodeHasSufficientPID        24m (x4 over 25m) kubelet        Node workshop-
control-plane status is now: NodeHasSufficientPID
Normal    NodeHasSufficientMemory     24m (x5 over 25m) kubelet        Node workshop-
control-plane status is now: NodeHasSufficientMemory
Normal    NodeHasNoDiskPressure       24m (x5 over 25m) kubelet        Node workshop-
control-plane status is now: NodeHasNoDiskPressure
Normal    Starting                     24m              kubelet        Starting kubelet.
Normal    NodeHasSufficientMemory     24m              kubelet        Node workshop-
control-plane status is now: NodeHasSufficientMemory
Normal    NodeHasNoDiskPressure       24m              kubelet        Node workshop-
control-plane status is now: NodeHasNoDiskPressure
Normal    NodeHasSufficientPID        24m              kubelet        Node workshop-
control-plane status is now: NodeHasSufficientPID
Normal    NodeAllocatableEnforced     24m              kubelet        Updated Node
Allocatable limit across pods
Warning   readOnlySysFS               24m              kube-proxy     CRI error: /sys is

```

```
read-only: cannot modify conntrack limits, problems may arise later (If running
Docker, see docker issue #24000)
Normal    Starting                24m                  kube-proxy  Starting kube-
proxy.
Normal    NodeReady                  24m                  kubelet     Node workshop-
control-plane status is now: NodeReady
```

Delete the current kind cluster. If you have the default cluster, named **kind**, you do not have to use the `--name` option.

```
kind delete cluster --name workshop
```

OUTPUT:

```
❯ kind delete cluster --name workshop
Deleting cluster "workshop" ...
```

Create a cluster with 3 workers. create a file, called `mykind` with the directions below:

```
❯ vi mykind
```

Directives for the file `mykind`. This will build the control plane and 3 workers node.

```
kind: Cluster
apiVersion: kind.x-k8s.io/v1alpha4
# One control plane node and three "workers".
#
# While these will not add more real compute capacity and
# have limited isolation, this can be useful for testing
# rolling updates etc.
#
# The API-server and other control plane components will be
# on the control-plane node.
#
# You probably don't need this unless you are testing Kubernetes itself.
nodes:
- role: control-plane
- role: worker
- role: worker
- role: worker
```

To build the new cluster with 3 workers and 1 control-plane execute the following:

```
kind create cluster --config mykind
```


OUTPUT:

```
❯ kind create cluster --config mykind
Creating cluster "kind" ...
❯ Ensuring node image (kindest/node:v1.20.2) ❯
❯ Preparing nodes ❯ ❯ ❯
❯ Writing configuration ❯
❯ Starting control-plane ❯❯
❯ Installing CNI ❯
❯ Installing StorageClass ❯
❯ Joining worker nodes ❯
Set kubectl context to "kind-kind"
You can now use your cluster with:

k cluster-info --context kind-kind

Thanks for using kind! ❯
```

Check nodes

```
❯ kubectl get nodes
```

OUTPUT: We can see the workshop name for the control plane.

```
❯ k get nodes
```

NAME	STATUS	ROLES	AGE	VERSION
kind-control-plane	Ready	control-plane,master	2m35s	v1.20.2
kind-worker	Ready	<none>	2m4s	v1.20.2
kind-worker2	Ready	<none>	2m4s	v1.20.2
kind-worker3	Ready	<none>	2m4s	v1.20.2

OUTPUT: with the wide option

As you recall from our docker section, we will check how many containers are running in docker.

```
❯ docker ps
```

OUTPUT:

```

❏ docker ps
CONTAINER ID   IMAGE                                COMMAND                                  CREATED        STATUS
PORTS          NAMES
4edfee1fd18f   kindest/node:v1.20.2               "/usr/local/bin/entr..." 3 minutes ago  Up 3
minutes       127.0.0.1:54190->6443/tcp            kind-control-plane
5671a7b7c983   kindest/node:v1.20.2               "/usr/local/bin/entr..." 3 minutes ago  Up 3
minutes       kind-worker3
29c2eb8fa722   kindest/node:v1.20.2               "/usr/local/bin/entr..." 3 minutes ago  Up 3
minutes       kind-worker2
0812af2b6e37   kindest/node:v1.20.2               "/usr/local/bin/entr..." 3 minutes ago  Up 3
minutes       kind-worker

```

Once kubectl and kind are ready, open bash console and run this command.

```
k cluster-info
```

OUTPUT:

```

k cluster-info
Kubernetes control plane is running at https://127.0.0.1:39553
KubeDNS is running at https://127.0.0.1:39553/api/v1/namespaces/kube-
system/services/kube-dns:dns/proxy

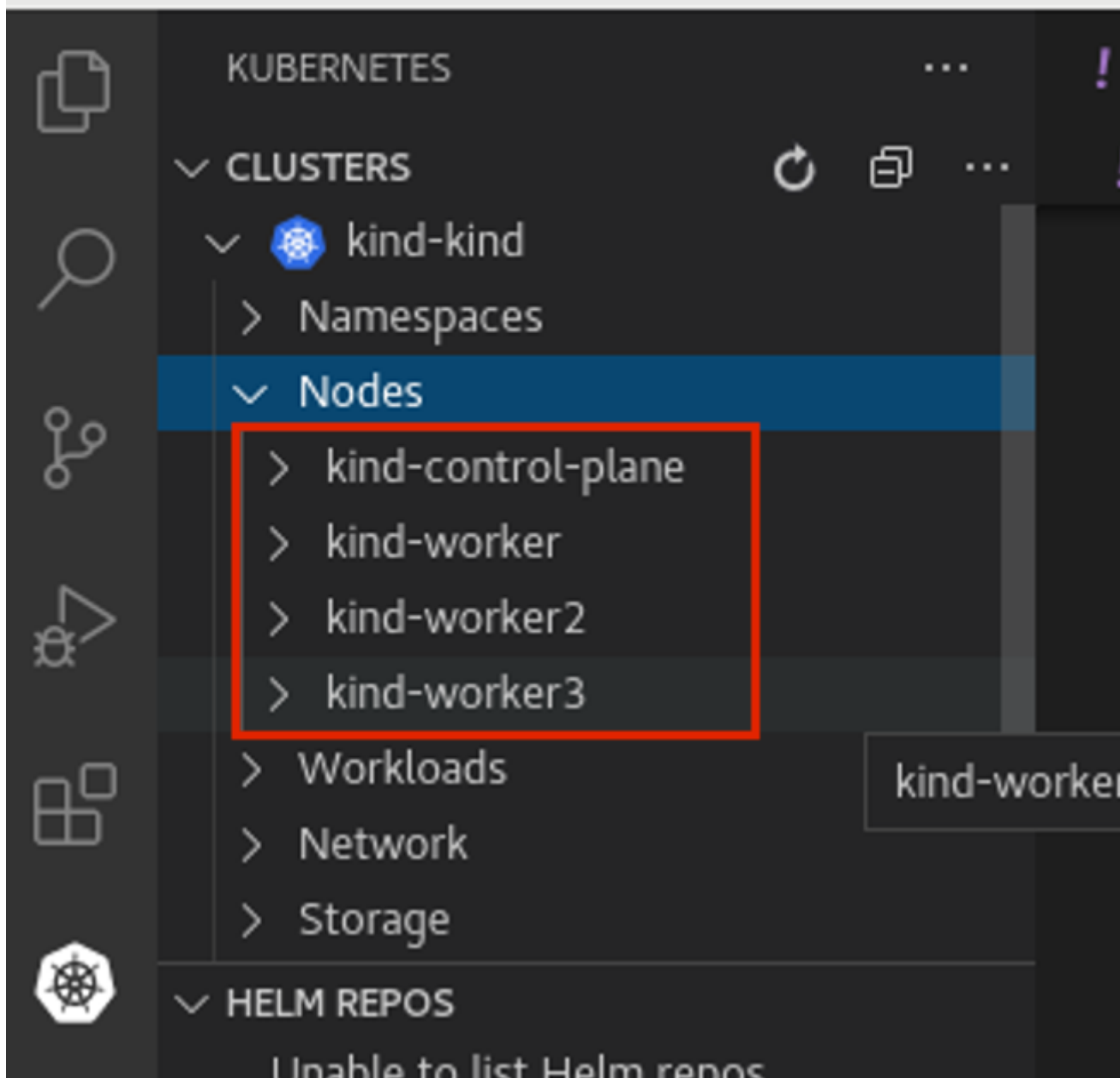
To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.

```

Let's check the vscode kube cluster window we will see the nodes there let's verify them with the cli

Open vscode, from the cli type **code**, Since this is an overview, we are not going to use VSCode that much, just wanted to share so you could take advantage of the great plugin offered within the VSCode community.

File Edit Selection View Go Run Terminal



```
k get nodes
```

OUTPUT:

NAME	STATUS	ROLES	AGE	VERSION
kind-control-plane	Ready	control-plane,master	7m14s	v1.20.2
kind-worker	Ready	<none>	6m45s	v1.20.2
kind-worker2	Ready	<none>	6m46s	v1.20.2
kind-worker3	Ready	<none>	6m46s	v1.20.2

Build a frontend using wordpress and backend using mysql

Luckily, there is an official tutorial which is pretty well described. We can try most steps of it using kind cluster which we just created. [Kubernetes Docs](#)

We will create 3 files and add the following data.

First we make a dir/folder

```
mkdir k8folder
```

We will cd into the folder k8folder before we do the next steps.

You can copy and paste it, which creates a secret and sets a password to f5demo.

```
❏ cat <<EOF >./kustomization.yaml
secretGenerator:
- name: mysql-pass
  literals:
  - password=f5demo
EOF
```

OUTPUT:

```
❏ cat kustomization.yaml
secretGenerator:
- name: mysql-pass
  literals:
  - password=f5demo
```

Now we will get the mysql deployment, the curl will save the file locally.

```
❏ curl -LO https://k8s.io/examples/application/wordpress/mysql-deployment.yaml
```

OUTPUT:

```
❏ curl -LO https://k8s.io/examples/application/wordpress/mysql-deployment.yaml
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
           Dload  Upload   Total   Spent    Left   Speed
100  178  100  178    0     0    751      0 --:--:-- --:--:-- --:--:--   751
100 1193  100 1193    0     0  2475      0 --:--:-- --:--:-- --:--:-- 17289
```

READ mysql deployment file and change the 20Gi to 10Gi

```
❏ cat mysql-deployment.yaml
apiVersion: v1
kind: Service
metadata:
  name: wordpress-mysql
  labels:
    app: wordpress
spec:
  ports:
    - port: 3306
  selector:
    app: wordpress
    tier: mysql
  clusterIP: None
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mysql-pv-claim
  labels:
    app: wordpress
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 20Gi
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: wordpress-mysql
  labels:
    app: wordpress
spec:
  selector:
    matchLabels:
      app: wordpress
      tier: mysql
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app: wordpress
        tier: mysql
    spec:
      containers:
        - image: mysql:5.6
          name: mysql
          env:
```

```

- name: MYSQL_ROOT_PASSWORD
  valueFrom:
    secretKeyRef:
      name: mysql-pass
      key: password
  ports:
  - containerPort: 3306
    name: mysql
  volumeMounts:
  - name: mysql-persistent-storage
    mountPath: /var/lib/mysql
  volumes:
  - name: mysql-persistent-storage
    persistentVolumeClaim:
      claimName: mysql-pv-claim

```

We notice the version of MySQL as well as the key for the password. In addition we will be able to see the port used by the container.

We will now get the wordpress deployment as well, using curl.

```
❏ curl -LO https://k8s.io/examples/application/wordpress/wordpress-deployment.yaml
```

OUTPUT:

```
❏ curl -LO https://k8s.io/examples/application/wordpress/wordpress-deployment.yaml
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  178  100  178    0     0   2022      0 --:--:-- --:--:-- --:--:--  2000
100 1278  100 1278    0     0   7139      0 --:--:-- --:--:-- --:--:--  7139
```

READ wordpress deployment file and change the 20Gi to 10Gi

```
❏ cat wordpress-deployment.yaml
apiVersion: v1
kind: Service
metadata:
  name: wordpress
  labels:
    app: wordpress
spec:
  ports:
  - port: 80
  selector:
    app: wordpress
    tier: frontend
  type: LoadBalancer
---
```

```

apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: wp-pv-claim
  labels:
    app: wordpress
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 20Gi
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: wordpress
  labels:
    app: wordpress
spec:
  selector:
    matchLabels:
      app: wordpress
      tier: frontend
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app: wordpress
        tier: frontend
    spec:
      containers:
        - image: wordpress:4.8-apache
          name: wordpress
          env:
            - name: WORDPRESS_DB_HOST
              value: wordpress-mysql
            - name: WORDPRESS_DB_PASSWORD
              valueFrom:
                secretKeyRef:
                  name: mysql-pass
                  key: password
          ports:
            - containerPort: 80
              name: wordpress
          volumeMounts:
            - name: wordpress-persistent-storage
              mountPath: /var/www/html
      volumes:
        - name: wordpress-persistent-storage

```

```
persistentVolumeClaim:
  claimName: wp-pv-claim
```

As well as mysql, we can see which port is used and which image is going to be launched for the frontend wordpress.

As we have downloaded the two files for our deployment, we will now add the resources into our original file called kustomization. The following data will be appended.

```
cat <<EOF >>./kustomization.yaml
resources:
- mysql-deployment.yaml
- wordpress-deployment.yaml
EOF
```

Let's look how the file is now constructed

```
❯ cat kustomization.yaml
secretGenerator:
- name: mysql-pass
  literals:
  - password=f5demo
resources:
- mysql-deployment.yaml
- wordpress-deployment.yaml
```

As we have all our files and configuration we will execute them using the kubectl command to start the deployment. Instead of running each command separately, we will leverage the flag -k.

NOTE	from the help the -k shows us the following: -k, --kustomize="": Process a kustomization directory. This flag can't be used together with -f or -R. --openapi-patch=true: If true, use openapi to calculate diff when the openapi presents and the resource can be found in the openapi spec. Otherwise, fall back to use baked-in types.
-------------	---

```
k apply -k ./
```

OUTPUT:


```
k apply -k .
secret/mysql-pass-7564dm6k4b created
service/wordpress-mysql created
service/wordpress created
deployment.apps/wordpress-mysql created
deployment.apps/wordpress created
persistentvolumeclaim/mysql-pv-claim created
persistentvolumeclaim/wp-pv-claim created
```

Now let's check the secrets.

```
k get secrets
```

OUTPUT:

```
k get secrets
```

NAME	TYPE	DATA	AGE
default-token-rkcdp	kubernetes.io/service-account-token	3	22h
mysql-pass-7564dm6k4b	Opaque	1	79s

We want to get a little more information from that, therefore, we will run the describe flag.

```
k describe secrets mysql-pass
```

OUTPUT:

```
k describe secrets mysql-pass
Name:          mysql-pass-7564dm6k4b
Namespace:     default
Labels:        <none>
Annotations:   <none>

Type: Opaque

Data
====
password:  6 bytes
```

Let's get verify the password we set. We will use the jsonpath for this command and base64 to read the data above called password.

```
k get secrets mysql-pass-28kbb7fbdm -o jsonpath="{.data.password}"|base64 --decode
```

OUTPUT:

```
k get secrets mysql-pass-28kbb7fbdm -o jsonpath='{.data.password}' | base64 --decode  
ciao[student@ip-10-1-1-6]$
```

To confirm the value in the POD we will exec into the POD.

```
k exec -it wordpress-mysql-5f7dc9d95d-zrzg5 -- env|grep -i pass
```

OUTPUT:

```
k exec -it wordpress-mysql-5f7dc9d95d-zrzg5 -- env|grep -i pass  
MYSQL_ROOT_PASSWORD=ciao
```

We do, however want to understand how storage is used on the container, and what we built with K8s. If you scroll up you will see the reference Volumes and the name used for that container. Therefore, we want to check that out.

```
k get pvc,pv
```

OUTPUT:

```
k get pvc,pv
```

NAME	CAPACITY	ACCESS MODES	STORAGECLASS	STATUS	AGE	VOLUME
persistentvolumeclaim/mysql-pv-claim	10Gi	RWO	standard	Bound	4m21s	pvc-04383fcb-9964-419e-9287-65a6692b7fff
persistentvolumeclaim/wp-pv-claim	10Gi	RWO	standard	Bound	4m21s	pvc-75b7e03f-d4b4-46e9-8393-c61be247e95f

NAME	RECLAIM POLICY	STATUS	CLAIM	STORAGECLASS	CAPACITY	ACCESS MODES	REASON	AGE
persistentvolume/pvc-04383fcb-9964-419e-9287-65a6692b7fff	Delete	Bound	default/mysql-pv-claim	standard	10Gi	RWO		4m17s
persistentvolume/pvc-75b7e03f-d4b4-46e9-8393-c61be247e95f	Delete	Bound	default/wp-pv-claim	standard	10Gi	RWO		4m18s

As we can see the name matches with what's in the describe.

As we have started our deployment, now let's check our pods. The second command is giving you the exact output of the first, however, less typing.

```
k get pods (full)  
k get po
```

We want to use services in K8s for many reason we have discussed during our presentation, now

let's check them.

```
k get services <name of the services>
k get svc <name of the services >
```

OUTPUT:

```
k get svc
NAME                TYPE          CLUSTER-IP    EXTERNAL-IP    PORT(S)        AGE
kubernetes          ClusterIP     10.96.0.1     <none>         443/TCP        22h
wordpress           LoadBalancer 10.96.212.79  <pending>      80:30782/TCP   12m
wordpress-mysql     ClusterIP     None          <none>         3306/TCP       12m
```

The above command shows you what's in the default namespace, if you want or need to check out a specific namespace, then you can use the -A option or -n follow by the namespace name. Furthermore,

OUTPUT -A

```
❏ k get svc -A
NAMESPACE   NAME                TYPE          CLUSTER-IP    EXTERNAL-IP    PORT(S)        AGE
default     kubernetes          ClusterIP     10.96.0.1     <none>         443/TCP        22h
default     wordpress           LoadBalancer 10.96.212.79  <pending>      80:30782/TCP   12m
default     wordpress-mysql     ClusterIP     None          <none>         3306/TCP       12m
kube-system kube-dns            ClusterIP     10.96.0.10    <none>         53/UDP,53/TCP,9153/TCP 22h
```

Endpoints are important and therefore we want to get as much data as possible. Example: (ip addresses of the pods). If the POD does not have an endpoint there is no svc associated with the pod.

```
k get endpoints
```

OUTPUT:

```
❏ k get endpoints
NAME                ENDPOINTS          AGE
kubernetes          172.18.0.4:6443    22h
wordpress           10.244.1.3:80      15m
wordpress-mysql     10.244.3.3:3306    15m
```

If we are looking at this, we can detect that each node has it's block, 10.244.1.x for pod 3, 10.244.3.x for pod 2 etc.

To make sure that's the case, let's check to confirm

```
k describe node kind-worker2
Name:                kind-worker2
Roles:               <none>
Labels:              beta.kubernetes.io/arch=amd64
                    beta.kubernetes.io/os=linux
                    kubernetes.io/arch=amd64
                    kubernetes.io/hostname=kind-worker2
                    kubernetes.io/os=linux
Annotations:         kubeadm.alpha.kubernetes.io/cri-socket:
                    unix:///run/containerd/containerd.sock
                    node.alpha.kubernetes.io/ttl: 0
                    volumes.kubernetes.io/controller-managed-attach-detach: true
CreationTimestamp:   Thu, 13 May 2021 12:35:30 -0700
Taints:              <none>
Unschedulable:       false
Lease:
  HolderIdentity:    kind-worker2
  AcquireTime:        <unset>
  RenewTime:         Fri, 14 May 2021 11:19:34 -0700
Conditions:
  Type                Status  LastHeartbeatTime               LastTransitionTime
Reason                Message
-----
-----
MemoryPressure        False   Fri, 14 May 2021 11:15:44 -0700   Thu, 13 May 2021 12:35:30
-0700 KubeletHasSufficientMemory kubelet has sufficient memory available
DiskPressure          False   Fri, 14 May 2021 11:15:44 -0700   Thu, 13 May 2021 12:35:30
-0700 KubeletHasNoDiskPressure kubelet has no disk pressure
PIDPressure           False   Fri, 14 May 2021 11:15:44 -0700   Thu, 13 May 2021 12:35:30
-0700 KubeletHasSufficientPID kubelet has sufficient PID available
Ready                 True     Fri, 14 May 2021 11:15:44 -0700   Thu, 13 May 2021 12:35:51
-0700 KubeletReady kubelet is posting ready status
Addresses:
  InternalIP: 172.18.0.3
  Hostname:   kind-worker2
Capacity:
  cpu:                8
  ephemeral-storage:  61255492Ki
  hugepages-1Gi:      0
  hugepages-2Mi:      0
  memory:             2034536Ki
  pods:               110
Allocatable:
  cpu:                8
  ephemeral-storage:  61255492Ki
```

```

hugepages-1Gi:      0
hugepages-2Mi:      0
memory:             2034536Ki
pods:               110
System Info:
Machine ID:          d1c0cbc1360a42b1b615caf2d2d8e63e
System UUID:          09dc1919-355b-4353-b8cf-d58045111f27
Boot ID:             ea3c38c2-56e1-41d4-8392-74320225a7a2
Kernel Version:      5.10.25-linuxkit
OS Image:            Ubuntu 20.10
Operating System:    linux
Architecture:        amd64
Container Runtime Version: containerd://1.4.0-106-gce4439a8
Kubelet Version:      v1.20.2
Kube-Proxy Version:   v1.20.2
PodCIDR:             10.244.3.0/24
PodCIDRs:            10.244.3.0/24
ProviderID:          kind://docker/kind/kind-worker2
Non-terminated Pods: (3 in total)
  Namespace          Name          CPU Requests  CPU
Limits  Memory Requests  Memory Limits  AGE
-----
default      wordpress-mysql-dd6c4c7c9-mkxfr  0 (0%)        0 (0%)
0 (0%)      0 (0%)        19m
kube-system  kindnet-mnhvz                    100m (1%)     100m
(1%) 50Mi (2%) 50Mi (2%) 22h
kube-system  kube-proxy-m87sm                 0 (0%)        0 (0%)
0 (0%)      0 (0%)        22h
Allocated resources:
(Total limits may be over 100 percent, i.e., overcommitted.)
Resource      Requests  Limits
-----
cpu           100m (1%) 100m (1%)
memory        50Mi (2%) 50Mi (2%)
ephemeral-storage 0 (0%)    0 (0%)
hugepages-1Gi  0 (0%)    0 (0%)
hugepages-2Mi  0 (0%)    0 (0%)
Events:        <none>

```

NOTE | Check the cidr for that node.

Now we are at the final steps to access our application. As we have talked, there are 3 type in Kubernetes which allows you to access the container. One is NodePort, (not suggested for produciton), default is ClusterIP, which allows communication between the pods, and the last one is LoadBalancer, but we do not have an IPAM which gives us an IP address. Therefore, we will use port-forward to test the application we just span up.

```
k port-forward svc/wordpress 8000:80
```

OUTPUT:

```
k port-forward svc/wordpress 8000:80
Forwarding from 127.0.0.1:8000 -> 80
Forwarding from [::1]:8000 -> 80
```

NOTE do not break out from the terminal otherwise you will not be able to access the application. Open a new terminal.

As we have a MySQL container, and we know there is a password we set let's evaluate the pod. Find the password from the container info

```
k describe po wordpress-mysql (look for the MYSQL_ROOT_PASSWORD).
```

OUTPUT:

```
❏ k describe po wordpress-mysql
Name:          wordpress-mysql-dd6c4c7c9-mkxfg
Namespace:     default
Priority:       0
Node:          kind-worker2/172.18.0.3
Start Time:    Fri, 14 May 2021 11:00:05 -0700
Labels:        app=wordpress
               pod-template-hash=dd6c4c7c9
               tier=mysql
Annotations:   <none>
Status:        Running
IP:            10.244.3.3
IPs:
  IP:          10.244.3.3
Controlled By: ReplicaSet/wordpress-mysql-dd6c4c7c9
Containers:
  mysql:
    Container ID:
containerd://ca5c4a78d86a36a220aaf6c16e5e3af762b25d03ebd56f6633dfb80bba237d91
    Image:      mysql:5.6
    Image ID:   docker.io/library/mysql@sha256:1d96ea86f9173607f1534c05041bf18dba691ded86d2ab51f6fd4533377fac39
    Port:       3306/TCP
    Host Port:  0/TCP
    State:      Running
      Started:   Fri, 14 May 2021 11:00:15 -0700
    Ready:      True
```

```

Restart Count: 0
Environment:
  MYSQL_ROOT_PASSWORD: <set to the key 'password' in secret 'mysql-pass-7564dm6k4b'> Optional: false
Mounts:
  /var/lib/mysql from mysql-persistent-storage (rw)
  /var/run/secrets/kubernetes.io/serviceaccount from default-token-rkcdp (ro)
Conditions:
  Type              Status
  Initialized        True
  Ready              True
  ContainersReady    True
  PodScheduled       True
Volumes:
  mysql-persistent-storage:
    Type:          PersistentVolumeClaim (a reference to a PersistentVolumeClaim in the same namespace)
    ClaimName:     mysql-pv-claim
    ReadOnly:      false
  default-token-rkcdp:
    Type:          Secret (a volume populated by a Secret)
    SecretName:    default-token-rkcdp
    Optional:      false
QoS Class:         BestEffort
Node-Selectors:    <none>
Tolerations:       node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                   node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type    Reason      Age   From          Message
  ----    -
  Normal  Scheduled   27m   default-scheduler Successfully assigned default/wordpress-mysql-dd6c4c7c9-mkxfr to kind-worker2
  Normal  Pulling     27m   kubelet        Pulling image "mysql:5.6"
  Normal  Pulled      27m   kubelet        Successfully pulled image "mysql:5.6" in 8.7183841s
  Normal  Created     27m   kubelet        Created container mysql
  Normal  Started     27m   kubelet        Started container mysql

```

Now let's open firefox and go to

```
localhost:8000
```

Spend a few min configuring your new application.

Optional Lab,

to see how scale works we will start with one and then scale up and down.

Scale example:

Run a new deployment

```
k create deployment grey --image=itlinux/httpd_grey
```

OUTPUT:

```
k get deploy
NAME                READY    UP-TO-DATE    AVAILABLE    AGE
grey                 1/1      1              0            13s
wordpress            1/1      1              1            36m
wordpress-mysql      1/1      1              1            36m
```

Now let's leverage help

```
k scale -h
```

OUTPUT:

```
❏ k scale -h
Set a new size for a Deployment, ReplicaSet, Replication Controller, or StatefulSet.

Scale also allows users to specify one or more preconditions for the scale action.

If --current-replicas or --resource-version is specified, it is validated before the
scale is attempted, and it is
guaranteed that the precondition holds true when the scale is sent to the server.

Examples:
# Scale a replicaset named 'foo' to 3.
kubectl scale --replicas=3 rs/foo

# Scale a resource identified by type and name specified in "foo.yaml" to 3.
kubectl scale --replicas=3 -f foo.yaml

# If the deployment named mysql's current size is 2, scale mysql to 3.
kubectl scale --current-replicas=2 --replicas=3 deployment/mysql

# Scale multiple replication controllers.
kubectl scale --replicas=5 rc/foo rc/bar rc/baz

# Scale statefulset named 'web' to 3.
kubectl scale --replicas=3 statefulset/web

Options:
  --all=false: Select all resources in the namespace of the specified resource
types
  --allow-missing-template-keys=true: If true, ignore any errors in templates when
a field or map key is missing in
the template. Only applies to goyaml and jsonpath output formats.
```


`--current-replicas=-1`: Precondition for current size. Requires that the current size of the resource match this value in order to scale.

`--dry-run='none'`: Must be "none", "server", or "client". If client strategy, only print the object that would be sent, without sending it. If server strategy, submit server-side request without persisting the resource.

`-f, --filename=[]`: Filename, directory, or URL to files identifying the resource to set a new size

`-k, --kustomize=''`: Process the kustomization directory. This flag can't be used together with `-f` or `-R`.

`-o, --output=''`: Output format. One of: `json|yaml|name|go-template|go-template-file|template|templatefile|jsonpath|jsonpath-as-json|jsonpath-file`.

`--record=false`: Record current kubectl command in the resource annotation. If set to false, do not record the command. If set to true, record the command. If not set, default to updating the existing annotation value only if one already exists.

`-R, --recursive=false`: Process the directory used in `-f, --filename` recursively. Useful when you want to manage related manifests organized within the same directory.

`--replicas=0`: The new desired number of replicas. Required.

`--resource-version=''`: Precondition for resource version. Requires that the current resource version match this value in order to scale.

`-l, --selector=''`: Selector (label query) to filter on, supports '=', '==', and '!='.(e.g. `-l key1=value1,key2=value2`)

`--template=''`: Template string or path to template file to use when `-o=go-template, -o=go-template-file`. The template format is golang templates [<http://golang.org/pkg/text/template/#pkg-overview>].

`--timeout=0s`: The length of time to wait before giving up on a scale operation, zero means don't wait. Any other values should contain a corresponding time unit (e.g. 1s, 2m, 3h).

Usage:

```
kubectl scale [--resource-version=version] [--current-replicas=count]
--replicas=COUNT (-f FILENAME | TYPE NAME)
[options]
```

Use "kubectl options" for a list of global command-line options (applies to all commands).

We notice in the Examples a scale for the deployment. Therefore, we will use a similar one, but first let's check our pods.

Pods

```
❏ k get pods
```

NAME	READY	STATUS	RESTARTS	AGE
grey-664f87894f-zr52n	1/1	Running	0	3m12s
wordpress-9f58bb5bc-pdn7r	1/1	Running	0	39m
wordpress-mysql-dd6c4c7c9-mkxfp	1/1	Running	0	39m

We do see there is only one grey pod. Now let's scale up. But before we scale let's make sure we can access the new container.

```
k port-forward deployment/grey 8222:80
```

Open firefox at

```
localhost:8222
```

Scale our Pod

```
❏ k scale --current-replicas=1 --replicas=3 deployment/grey
```

Now let's check pods again. .Pods

```
❏ k get pods
```

NAME	READY	STATUS	RESTARTS	AGE
grey-664f87894f-542x1	1/1	Running	0	13s
grey-664f87894f-8wvm5	1/1	Running	0	13s
grey-664f87894f-zr52n	1/1	Running	0	4m54s
wordpress-9f58bb5bc-pdn7r	1/1	Running	0	41m
wordpress-mysql-dd6c4c7c9-mkxfp	1/1	Running	0	41m

As well as we scaled up we can now scale down. Similar command.

```
❏ k scale --current-replicas=3 --replicas=1 deployment/grey
```

OUTPUT:

```
❏ k get pods
```

NAME	READY	STATUS	RESTARTS	AGE
grey-664f87894f-542xl	1/1	Running	0	2m13s
grey-664f87894f-8wvm5	1/1	Terminating	0	2m13s
grey-664f87894f-zr52n	1/1	Terminating	0	6m54s
wordpress-9f58bb5bc-pdn7r	1/1	Running	0	43m
wordpress-mysql-dd6c4c7c9-mkxfp	1/1	Running	0	43m

NOTE | your application still runs :) even when we scaled down.

If we want to access a specific worker node where the app is running for the grey app, you can use the following as an example, your id maybe diff:

```
k port-forward grey-5794d7f866-w8t98 8088:80
```

This ends the lab.

Thanks