LAB – Lightweight IaaS platforms

Hands on experience with Kubernetes installation

References:

- Kubernetes documentation https://kubernetes.io/docs/home/

Charmed Bundle

- Charmed bundle is a type of juju installation in which everything is automated
- A Yaml file describes which components and where they should be installed
- For each component the configuration is also specified

Deploy Kubernetes

- Download a standard bundle and customize

```
wget https://api.jujucharms.com/charmstore/v5/bundle/kubernetes-core-941/archive/bundle.yaml
```

- Deploy the bundle specifying where to install the controller node (node 10) and one worker (node 11)

```
juju deploy ./bundle.yaml --map-machines=existing,0=10,1=11
```

- If you have more than one worker extend the role to other machines (node 12 in this case)

```
juju add-unit --to 12 kubernetes-worker
```

Tutorial

https://jaas.ai/kubernetes-core

```
root@SNHOYM5GWPGME2L:~# juju deploy ./bundle.yaml
Resolving charm: cs:~containers/containerd-53
Resolving charm: cs:~containers/easyrsa-295
Resolving charm: cs:~containers/etcd-485
Resolving charm: cs:~containers/flannel-466
Resolving charm: cs:~containers/kubeapi-load-balancer-701
Resolving charm: cs:~containers/kubernetes-master-788
Resolving charm: cs:~containers/kubernetes-worker-623
Executing changes:
- upload charm cs:~containers/containerd-53 for series bionic
- deploy application containerd on bionic using cs:~containers/containerd-53
- set annotations for containerd
- upload charm cs:~containers/easyrsa-295 for series bionic
- deploy application easyrsa on bionic using cs:~containers/easyrsa-295
  added resource easyrsa
- set annotations for easyrsa
- upload charm cs:~containers/etcd-485 for series bionic
- deploy application etcd on bionic using cs:~containers/etcd-485
  added resource core
  added resource etcd
  added resource snapshot
- set annotations for etcd
- upload charm cs:~containers/flannel-466 for series bionic
- deploy application flannel on bionic using cs:~containers/flannel-466
  added resource flannel-amd64
  added resource flannel-arm64
  added resource flannel-s390x
- set annotations for flannel
- upload charm cs:~containers/kubeapi-load-balancer-701 for series bionic
- deploy application kubeapi-load-balancer on bionic using cs:~containers/kubeapi-load-balancer-701
- expose kubeapi-load-balancer
- set annotations for kubeapi-load-balancer
- upload charm cs:~containers/kubernetes-master-788 for series bionic
- deploy application kubernetes-master on bionic using cs:~containers/kubernetes-master-788
  added resource cdk-addons
  added resource core
  added resource kube-apiserver
  added resource kube-controller-manager
  added resource kube-proxy
  added resource kube-scheduler
  added resource kubectl
- set annotations for kubernetes-master
- upload charm cs:~containers/kubernetes-worker-623 for series bionic
- deploy application kubernetes-worker on bionic using cs:~containers/kubernetes-worker-623
  added resource cni-amd64
  added resource cni-arm64
  added resource cni-s390x
  added resource core
  added resource kube-proxy
  added resource kubectl
  added resource kubelet
```


root@SNHOYM5GWPGME2L:~# juju status
Model Controller Cloud/Region Version SLA Timestamp
default manual-controller mycloud/default 2.7.0 unsupported 14:42:27Z
App Version Status Scale Charm Store Rev OS Notes
containerd waiting 0 containerd jujucharms 53 ubuntu
easyrsa waiting 0/1 easyrsa jujucharms 295 ubuntu
etcd maintenance 1 etcd jujucharms 485 ubuntu
flannel waiting 0 flannel jujucharms 466 ubuntu
kubernetes-master waiting 0/1 kubernetes-master jujucharms 788 ubuntu exposed
kubernetes-worker maintenance 1 kubernetes-worker jujucharms 623 ubuntu exposed
Unit Workload Agent Machine Public address Ports Message
easyrsa/6 waiting allocating 21/lxd/0 waiting for machine
etcd/8* maintenance executing 21 172.16.0.110 (install) installing charm software
kubernetes-master/7* waiting allocating 21 172.16.0.110 agent initializing
kubernetes-worker/8* maintenance executing 22 172.16.0.109 (install) installing charm software
Machine State DNS Inst id Series AZ Message
12 started 172.16.0.111 manual:172.16.0.111 bionic Manually provisioned machine
21 started 172.16.0.110 manual:172.16.0.110 bionic Manually provisioned machine
21/lxd/0 pending pending bionic Retrieving image: rootfs: 27% (24.50MB/s)
22 started 172.16.0.109 manual:172.16.0.109 bionic Manually provisioned machine
root@SNHOYM5GWPGME2L:~#

```
root@SNHOYM5GWPGME2L:~# juju status
Model    Controller          Cloud/Region     Version  SLA          Timestamp
default  manual-controller   mycloud/default  2.7.0    unsupported  15:03:22Z

App                Version  Status  Scale  Charm              Store       Rev  OS      Notes
containerd         1.3.3    active      3  containerd         jujucharms   53  ubuntu
easyrsa            3.0.1    active      1  easyrsa            jujucharms  295  ubuntu
etcd               3.3.15   active      1  etcd               jujucharms  485  ubuntu
flannel            0.11.0   active      3  flannel            jujucharms  466  ubuntu
kubernetes-master  1.17.0   active      1  kubernetes-master  jujucharms  788  ubuntu  exposed
kubernetes-worker  1.17.0   active      2  kubernetes-worker  jujucharms  623  ubuntu  exposed

Unit                  Workload  Agent      Machine   Public address  Ports           Message
easyrsa/6*            active    idle       21/lxd/0  10.104.131.111                  Certificate Authority connected.
etcd/8*               active    idle       21        172.16.0.110    2379/tcp        Healthy with 1 known peer
kubernetes-master/7*  active    idle       21        172.16.0.110    6443/tcp        Kubernetes master running.
  containerd/2        active    idle                 172.16.0.110                    Container runtime available
  flannel/2           active    idle                 172.16.0.110                    Flannel subnet 10.1.88.1/24
kubernetes-worker/8*  active    idle       22        172.16.0.109    80/tcp,443/tcp  Kubernetes worker running.
  containerd/1*       active    idle                 172.16.0.109                    Container runtime available
  flannel/1*          active    idle                 172.16.0.109                    Flannel subnet 10.1.76.1/24
kubernetes-worker/9   active    executing  12        172.16.0.111                    Kubernetes worker running.
  containerd/3        active    idle                 172.16.0.111                    Container runtime available
  flannel/3           active    idle                 172.16.0.111                    Flannel subnet 10.1.43.1/24

Machine   State    DNS           Inst id                Series  AZ  Message
12        started  172.16.0.111  manual:172.16.0.111    bionic      Manually provisioned machine
21        started  172.16.0.110  manual:172.16.0.110    bionic      Manually provisioned machine
21/lxd/0  started  10.104.131.111  juju-6bdf2f-21-lxd-0  bionic      Container started
22        started  172.16.0.109  manual:172.16.0.109    bionic      Manually provisioned machine
```

Minikube

- An alternative installation method is available for test environment
- This method is named *minikube* in which a Kubernetes installation is run in a single environment
- Download minikube

```
curl -Lo minikube
https://storage.googleapis.com/minikube/releases/latest/minikube-
linux-amd64 \ && chmod +x minikube
```

```
sudo mkdir -p /usr/local/bin/
sudo install minikube /usr/local/bin/
```

Installation

- Install the environment

```
sudo apt-get install -y conntrack
sudo minikube start --driver=none
```

- Check the status

```
sudo minikube status
```

```
ubuntu@haproxy:~$ sudo minikube status
minikube
type: Control Plane
host: Running
kubelet: Running
apiserver: Running
kubeconfig: Configured
```

```
ubuntu@haproxy:~$ sudo minikube start --driver=none
minikube v1.10.1 on Ubuntu 18.04
Using the none driver based on user configuration
Starting control plane node minikube in cluster minikube
Running on localhost (CPUs=4, Memory=3944MB, Disk=19673MB) ...
OS release is Ubuntu 18.04.3 LTS
Preparing Kubernetes v1.18.2 on Docker 19.03.8 ...
  ▪ kubelet.resolv-conf=/run/systemd/resolve/resolv.conf
  > kubectl.sha256: 65 B / 65 B [--------------------------] 100.00% ? p/s 0s
  > kubeadm.sha256: 65 B / 65 B [--------------------------] 100.00% ? p/s 0s
  > kubelet.sha256: 65 B / 65 B [--------------------------] 100.00% ? p/s 0s
  > kubectl: 41.99 MiB / 41.99 MiB [--------------] 100.00% 45.19 MiB p/s 1s
  > kubeadm: 37.97 MiB / 37.97 MiB [--------------] 100.00% 25.53 MiB p/s 1s
  > kubelet: 108.03 MiB / 108.03 MiB [-------------] 100.00% 59.93 MiB p/s 2s

Configuring local host environment ...

! The 'none' driver is designed for experts who need to integrate with an existing VM
Most users should use the newer 'docker' driver instead, which does not require root!
For more information, see: https://minikube.sigs.k8s.io/docs/reference/drivers/none/

! kubectl and minikube configuration will be stored in /home/ubuntu
! To use kubectl or minikube commands as your own user, you may need to relocate them. For example, to overwrite your own settings, run:

  ▪ sudo mv /home/ubuntu/.kube /home/ubuntu/.minikube $HOME
  ▪ sudo chown -R $USER $HOME/.kube $HOME/.minikube

This can also be done automatically by setting the env var CHANGE_MINIKUBE_NONE_USER=true
Verifying Kubernetes components...
Enabled addons: default-storageclass, storage-provisioner
Done! kubectl is now configured to use "minikube"
For best results, install kubectl: https://kubernetes.io/docs/tasks/tools/install-kubectl/
```

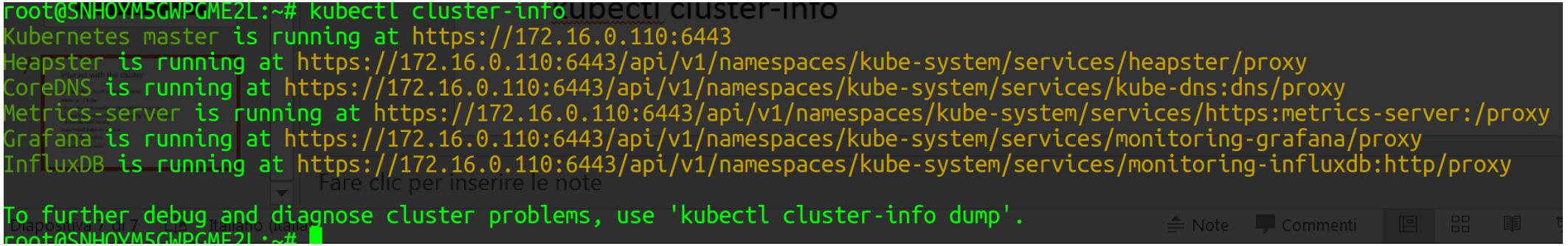
Interact with the cluster

- Install kubectl

```
snap install kubectl –classic
```

- Query the cluster.

```
sudo kubectl cluster-info
```



Get nodes

- **`kubectl get nodes`**

```
root@SNHOYM5GWPGME2L:~# kubectl get nodes
NAME                 STATUS   ROLES    AGE   VERSION
jpvhbab2n8ymtoa      Ready    <none>   26m   v1.17.0
ns0s334qagxcdw1      Ready    <none>   17m   v1.17.0
root@SNHOYM5GWPGME2L:~#
```

Install additional modules

- Install a LoadBalancer module

```
kubectl apply -f
https://raw.githubusercontent.com/google/metallb/v0.8.3/manifests/metallb.yaml
```

Check installation

kubectl get all -n metallb-system

```
root@SNHOYM5GWPGME2L:~# kubectl get all -n metallb-system
NAME                                READY   STATUS    RESTARTS   AGE
pod/controller-65895b47d4-mjpkz     1/1     Running   0          71m
pod/speaker-ml5xr                   1/1     Running   0          71m
pod/speaker-qr5zz                   1/1     Running   0          71m

NAME                       DESIRED   CURRENT   READY   UP-TO-DATE   AVAILABLE   NODE SELECTOR                   AGE
daemonset.apps/speaker     2         2         2       2            2           beta.kubernetes.io/os=linux     71m

NAME                            READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/controller      1/1     1            1           71m

NAME                                       DESIRED   CURRENT   READY   AGE
replicaset.apps/controller-65895b47d4      1         1         1       71m
```

Configure the module

- LoadBalancer requires a pool of public ip addresses to be allocated to its functionalities (you'll see)
- Assume the pool is 192.168.1.10-192.168.1.50
- Create a configuration file

```
apiVersion: v1
kind: ConfigMap
metadata:
  namespace: metallb-system
  name: config
data:
  config: |
    address-pools:
    - name: default
      protocol: layer2
      addresses:
      - 192.168.1.10-192.168.1.50
```

Apply the configuration and check

kubectl create -f config-map.yaml

kubectl describe configmap config -n metallb-system

```
root@SNHOYM5GWPGME2L:~# kubectl describe configmap config -n metallb-system
Name:         config
Namespace:    metallb-system
Labels:       <none>
Annotations:  <none>

Data
====
config:
----
address-pools:
- name: default
  protocol: layer2
  addresses:
  - 172.16.1.1-172.16.1.5

Events:  <none>
```

Activate some plugins (only for minikube)

`minikube addons enable metrics-server`

```
root@haproxy:~# minikube addons list
|------------------------------|----------|--------------|
|         ADDON NAME           | PROFILE  |    STATUS    |
|------------------------------|----------|--------------|
| dashboard                    | minikube | disabled     |
| default-storageclass         | minikube | enabled ✅   |
| efk                          | minikube | disabled     |
| freshpod                     | minikube | disabled     |
| gvisor                       | minikube | disabled     |
| helm-tiller                  | minikube | disabled     |
| ingress                      | minikube | disabled     |
| ingress-dns                  | minikube | disabled     |
| istio                        | minikube | disabled     |
| istio-provisioner            | minikube | disabled     |
| logviewer                    | minikube | disabled     |
| metallb                      | minikube | disabled     |
| metrics-server               | minikube | enabled ✅   |
| nvidia-driver-installer      | minikube | disabled     |
| nvidia-gpu-device-plugin     | minikube | disabled     |
| registry                     | minikube | disabled     |
| registry-aliases             | minikube | disabled     |
| registry-creds               | minikube | disabled     |
| storage-provisioner          | minikube | enabled ✅   |
| storage-provisioner-gluster  | minikube | disabled     |
|------------------------------|----------|--------------|
```