CodingWithMe
LEARN BY CODING

Learn Kubernetes in 90 minutes

Larry Cai <larry.caiyu@gmail.com>

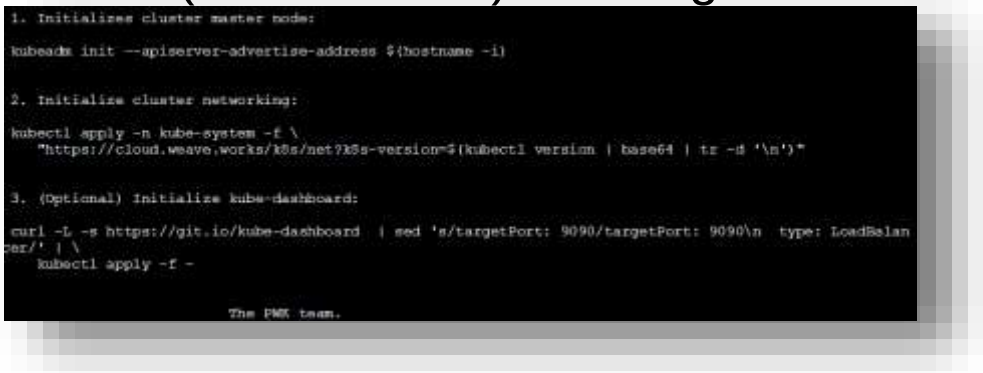
Agenda

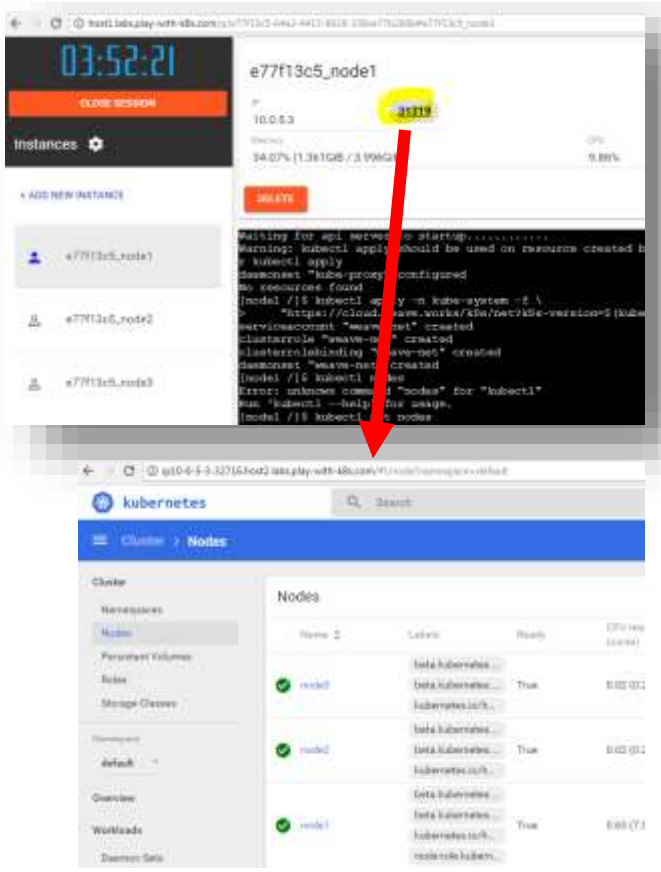
- Introduction
- Exercise 1: First web service in kubernetes
- Exercise 2: Revisit pod, deployment and service
- Exercise 3: Controller – Deployment (scale)
- Exercise 4: Deploy with YAML file
- Exercise 5: install Microservice: Guestbook
- Reference

Minikube environment setup is in appendix

Environment using k8s playground

- Three nodes in http://labs.play-with-k8s.com (master + 2 workers)
- Node 1 (master node): follow guideline step 1/2/3





If dashboard doesn't work, use https://git.io/vdc52

instead of https://git.io/kube-dashboard

- Node 2/Node 3

```
kubeadm join –token … # check the console log in Node 1
```

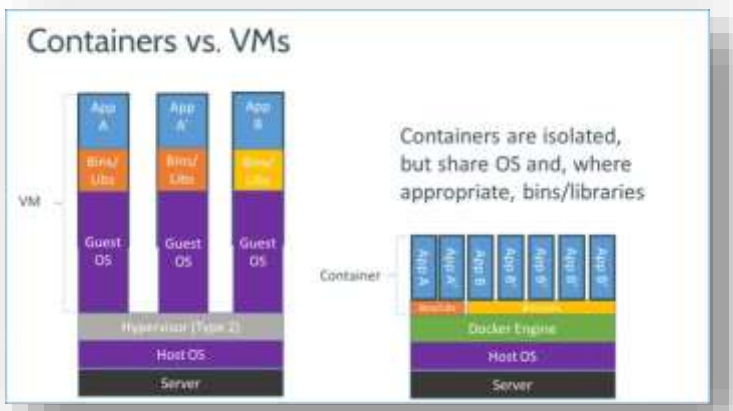
- Node 1:

```
kubectl get nodes
```

Try to use Ctrl-Ins & Shift-Ins for copy/paste

Background – Container/Docker

- Container technology offers an alternative method for virtualization in cloud, with more efficiency & fast
- New era for packaging and delivering software
- Docker is one execution engine for container
  - docker pull nginx
  - docker run --name web -d -p 8080:80 nginx
  - docker exec -it web bash
  - docker build -t larrycai/whoami .



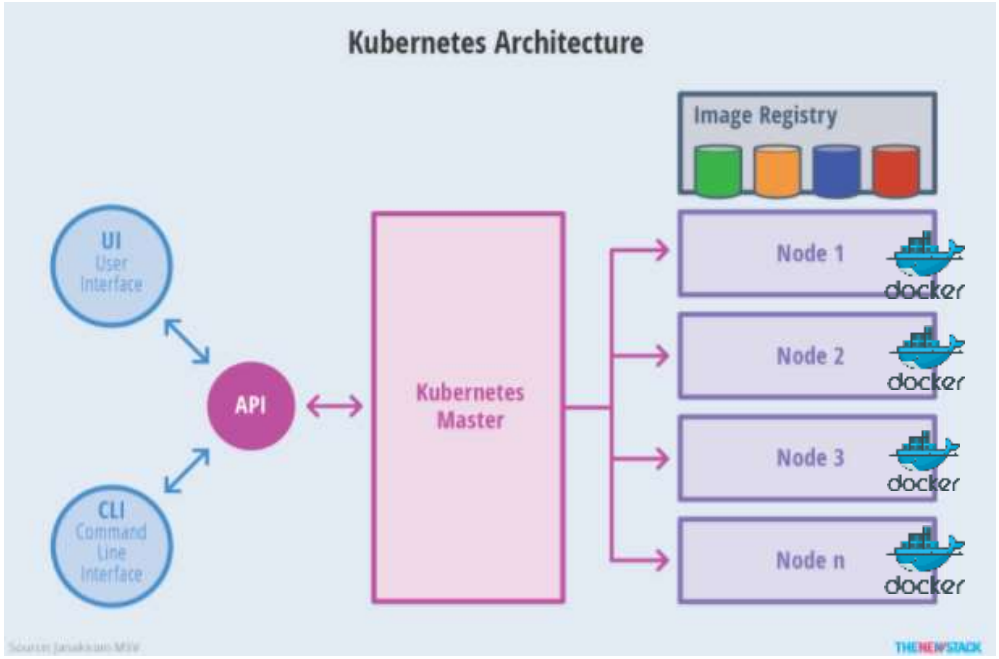
See more in CodingWithMe Docker
https://www.slideshare.net/larrycai/learn-docker-in-90-minutes

What is kubernetes ?

- Kubernetes is an open source **container orchestration platform** that helps manage distributed, containerized applications at massive scale.
  - Kubernetes (k8s) comes from google
  - kubernetes is a product platform to run container (Docker is one type of container execution engine)
    - k8s to container likes openstack to virtual machine.
- Key features (list partly):
  - Auto-scaling
  - Self-healing infrastructure
  - Application lifecycle management

K8s Architecture

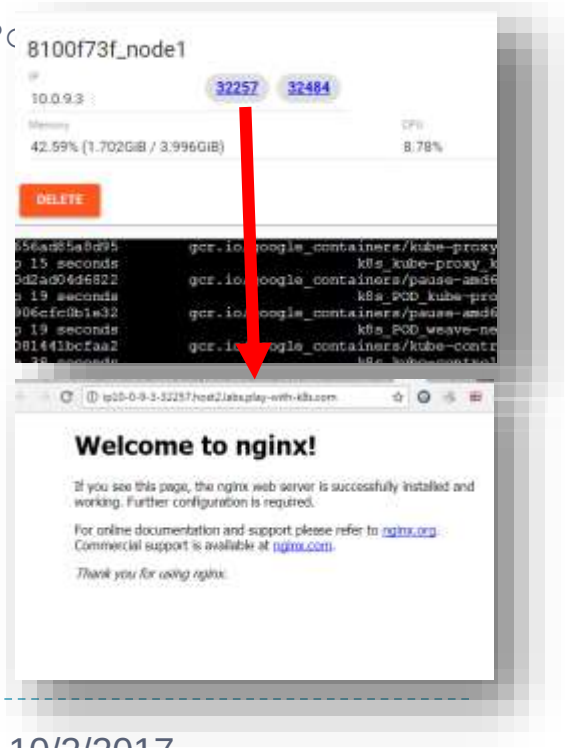
- Master and Work Node (multi or single)
- Container is executed in Work Node as default



Source: https://thenewstack.io/kubernetes-an-overview/

Exer 1: running first web service

- Let's start one web server in k8s (cloud)
  - Nginx is webserver like apache
- Start the service from official docker image https://hub.docker.com/_/nginx/
  - `kubectl run nginx --image=nginx --port=80`
  - `kubectl expose deployment nginx --type=NodePo`
- Check what happens
  - Check dashboard
  - Access the nginx web service (click new port)
  - `kubectl get pods`
  - `kubectl get pods -o wide # check node`
  - `kubectl get all`
  - `kubectl describe nodes`
  - `docker ps # in different node`
- Kill the pod ! And check again
  - `kubectl delete pods nginx-<xxx>`



Overall for running service

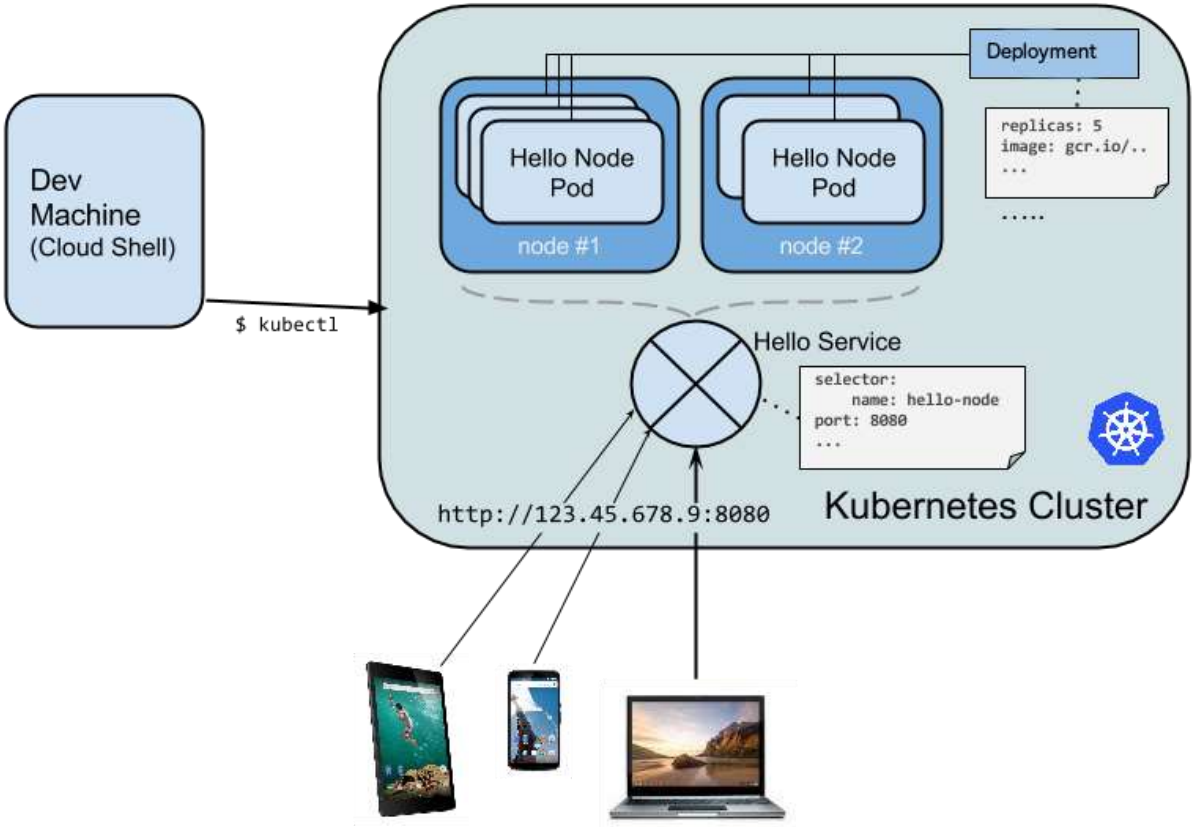
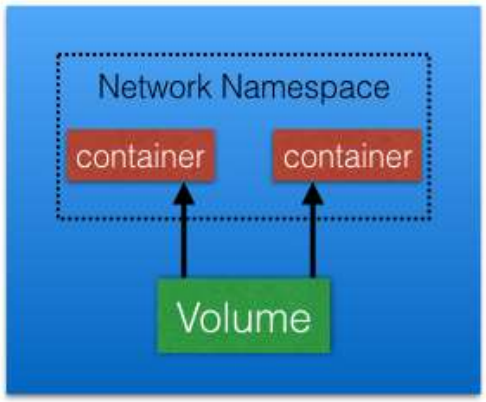


Image source https://kubernetes.io/images/hellonode/image_13.

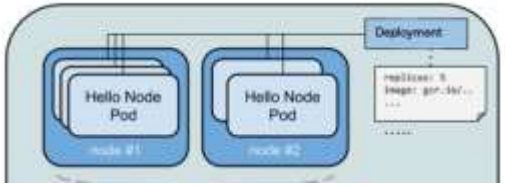
What is Pod ?

- A *pod* is a group of one or more containers (such as Docker containers), the shared storage for those containers
- Minimal element in kubernetes, run in one Node
- Command

```
kubectl run pods
kubectl get pods
kubectl delete pods
kubectl describe pods <pod>
kubectl exec -it <pod> -- bash
```



What is Deployment ?



- The Deployment is responsible for creating and updating instances of your application (using controller)
  - Once the application instances are created, a Kubernetes Deployment Controller continuously monitors those instances
- Default is one instance and keep active
- Review the command
- `kubectl run nginx --image=nginx --port=80 --replicas=1`
  - Download docker image nginx (from hub.docker.com) as internal port is 80
  - Run docker image inside pod named “nginx-xxx” with **1** instance
  - Deployment with name “nginx”
  - If pod is deleted, deployment control create new one

What is Service ?

- Service is an abstraction which defines a logical set of Pods and a policy by which to access them
  - sometimes called a micro-service
  - Service could be selected by label (skipped here)
- ServiceTypes defines how to expose a Service, The default is ClusterIP (internal)
  - NodeType : expose port in Kubernetes Master

    ```
    kubectl expose deployment xxx –
    type=NodePort
    ```

  - Load Balancer (need support in k8s infra)

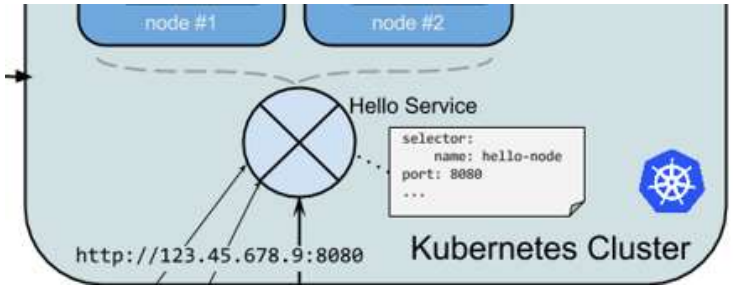
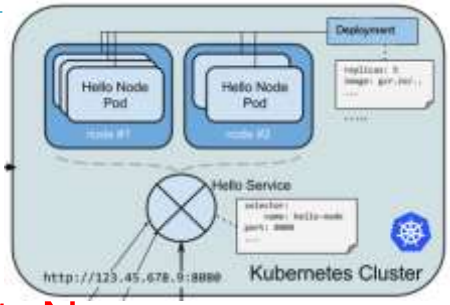


Image source: http://wso2.com/whitepapers/a-reference-architecture-for-deploying-wso2-middleware-on-kubernetes/

Exer 2: Revisit pod, deployment and service



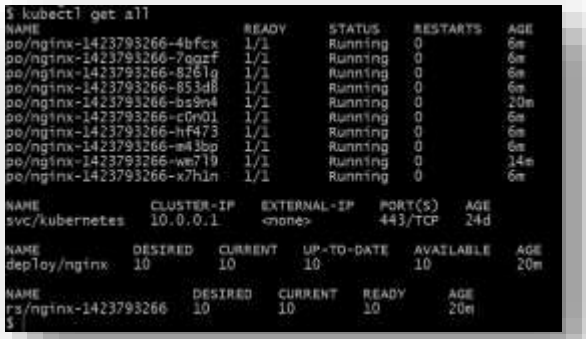
- Enter into container inside pod
  - kubectl exec -it nginx-xxx -- bash
- Start pod only without deployment
  - kubectl run nginx --image=nginx --port=80 --restart=Never
  - kubectl run -i --tty busybox --image=busybox -- sh
- Expose to another service
  - kubectl expose --name nginx2 deploy nginx
  - kubectl get service
  - curl <cluster ip>
  - kubectl expose --name nginx3 deploy nginx --type=NodePort
- Clean up the deployment and service
  - kubectl delete service xxx
  - kubectl delete deployment xxx # check pod removed or not

```
NAME              CLUSTER-IP       EXTERNAL-IP   PORT(S)        AGE
svc/kubernetes    10.96.0.1        <none>        443/TCP        1h
svc/nginx         10.106.110.76    <nodes>       80:32257/TCP   1h
svc/nginx2        10.107.22.29     <none>        80/TCP         36s
svc/nginx3        10.98.148.162    <nodes>       80:30032/TCP   17s
```

Deployment more

- Deployment describe the desired state in a Deployment object, and the Deployment controller will change the actual state to the desired state at a controlled rate for you
- Scale to wanted size (replicas)

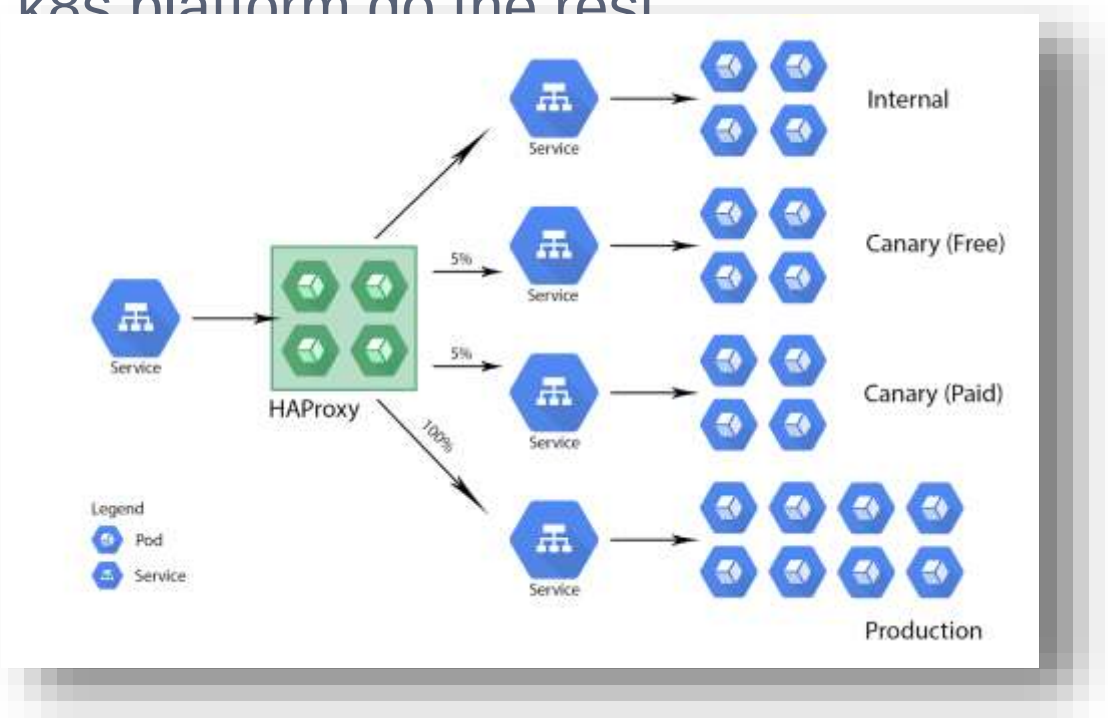
```
$ kubectl scale --replicas=2 deployment/nginx
$ kubectl scale --replicas=10 deployment/nginx
deployment "nginx" scaled
$ kubectl rollout status deployment/nginx
Waiting for rollout to finish: 2 of 10 updated replicas are available...
….
Waiting for rollout to finish: 9 of 10 updated replicas are available...
deployment "nginx" successfully rolled out
$ kubectl get pods
```



- Patch, Upgrade, Rollback ..
- Autoscale : grow when needed

One example: Canary release

- Kubernetes support to define own deploy strategy.
  - User takes care of the service and what it wants to expose
  - The k8s platform do the rest

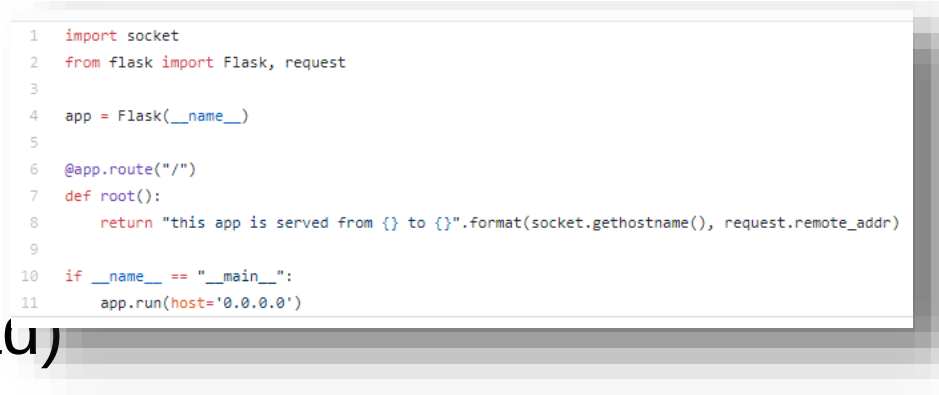


Source http://blog.kubernetes.io/2017/04/multi-stage-canary-deployments-with-kubernetes-in-the-cloud-onprem

Exer 3 : Deployment with Scale

- Show hostname (image: larrycai/whoami)

```
kubectl run whoami --image=larrycai/whoami --port=5000
kubectl expose deploy whoami --type=NodePort
```



```python
import socket
from flask import Flask, request

app = Flask(__name__)

@app.route("/")
def root():
    return "this app is served from {} to {}".format(socket.gethostname(), request.remote_addr)

if __name__ == "__main__":
    app.run(host='0.0.0.0')
```

- Check the webpage
- Delete

```
kubectl delete pods whoami-xxxx
```

- Check the webpage (reload)
- Scale

```
kubectl scale --replicas=5 deployment/whoami
kubectl rollout status deployment/whoami
kubectl get pods
```

- Check the webpage (reload)

YAML descriptors

- Kubectl command line to deal with objects with limited set of properties
  - Difficult to maintain and version control
- YAML file is used to manage the object

```
kubectl create -f node-pod.yaml
kubectl create -f http://example.com/nginx-pod.yaml
```

- Get full descriptions of the object in YAML

```
kubectl get pods nginx2 -o yaml
```

```yaml
---
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
    - name: nginx
      image: nginx
      ports:
        - containerPort: 80
```

Exer 4: deploy from YAML file

- Create whoami deploy yaml file (use pod as reference)

```
kubectl get deploy whoami -o yaml
```

- Download and create
  https://github.com/larrycai/codingwithme-k8s/blob/master/whoami.yaml

```
curl -L -o whoami.yaml https://git.io/v7yd8
kubectl delete service whoami
kubectl delete deploy whoami
kubectl create -f whoami.yaml
```

- Change the ReplicaSet to 5 and run

```
kubectl apply -f whoami.yaml
```

Microservices in Kubernetes

- Kubernetes is a great tool for microservices clustering and orchestration.
  - It is still a quite new and under active development
- Kubernetes provides lots of features to be used to deploy microservices
  - Declare in YAML to deploy them
- Kubernetes official tutorial Guestbook
  https://kubernetes.io/docs/tutorials/stateless-application/guestbook/

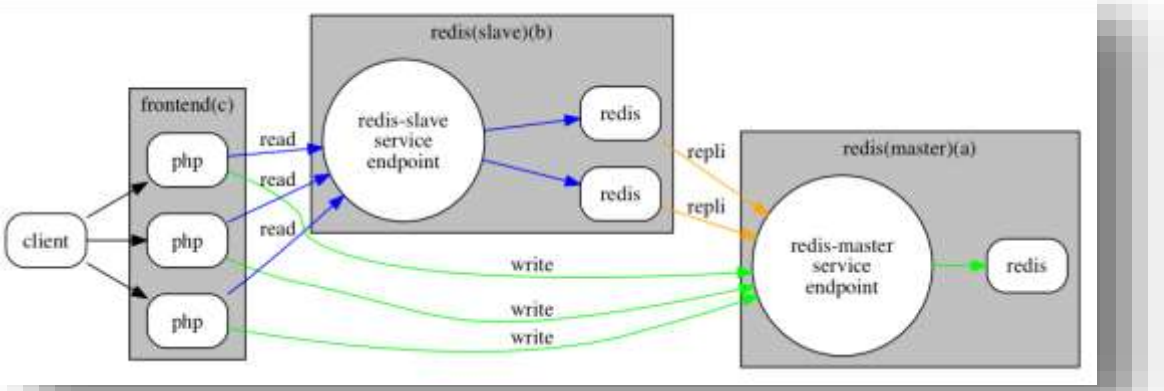
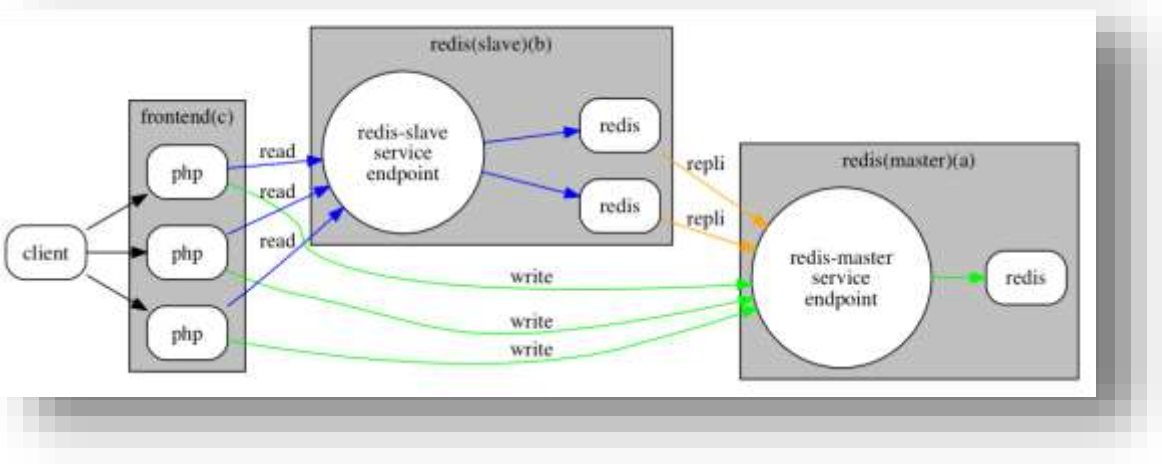
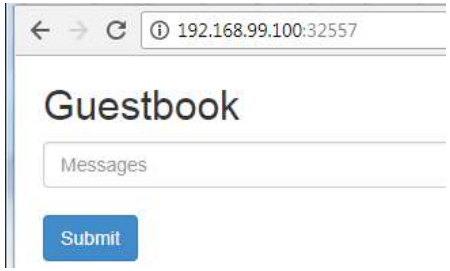


Image source: https://netmark.jp/wp-content/uploads/2014/12/guestbook-kubernetes.pr

Exer 5: Install Guestbook





- Deploy all in one

  `kubectl create -f https://git.io/v7ytR # shorturl to guestbook-all-in-one.yaml`

- Check dashboards
- Expose service to NodePort

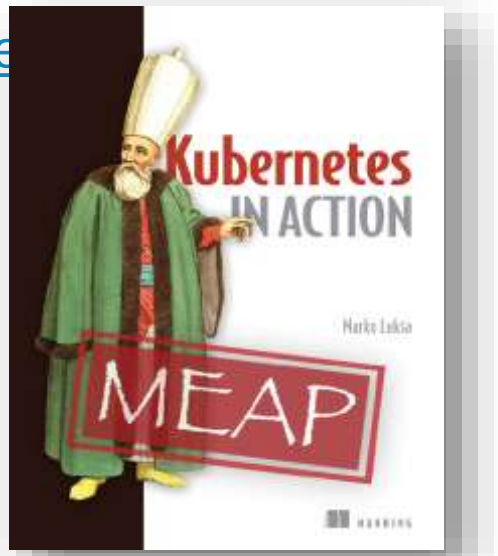
  `kubectl expose svc frontend --name f2 --type=NodePort`

Summary

- Kubernetes: a platform to run container (docker)
- Concept:
  - A *Node* is a worker machine in Kubernetes
  - A *Pod* is the basic building block of Kubernetes, which has a group of containers
  - *Deployment* controls the state of the pod (scale, replicate)
  - *Service* is an abstraction which defines a logical set of Pods and a policy by which to access them. (micro service ..)
- Kubernetes grows very fast, follow it.

Reference

- K8s doc: https://kubernetes.io/docs/home/
- Code: https://github.com/larrycai/codingwithme-k8s
- Minikube: https://github.com/kubernetes/minikube
- Blog: multi stage deployment with kubernetes: http://blog.kubernetes.io/2017/04/multi-stage-canary-deployments-with-kubernetes-in-the-cloud-onprem.html
- Video: The Illustrated Children's Guide to Kuberne
- Sandbox online: http://labs.play-with-k8s.com/
- Book: Kubernetes in Action (Manning)



CodingWithMe
LEARN BY CODING

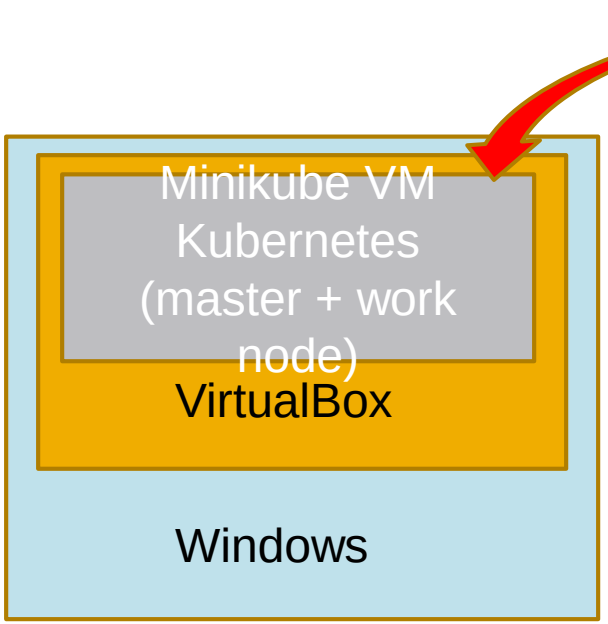
ChangeLog

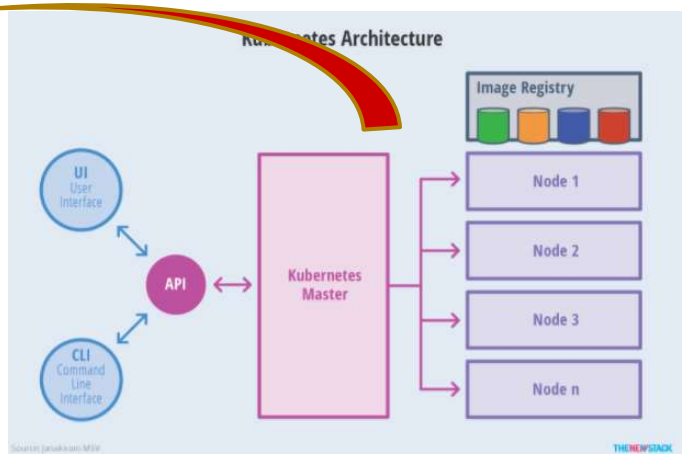
- 2017/07/23: first version
- 2017/08/11: use k8s playground
- 2017/10/2: fix dashboard url

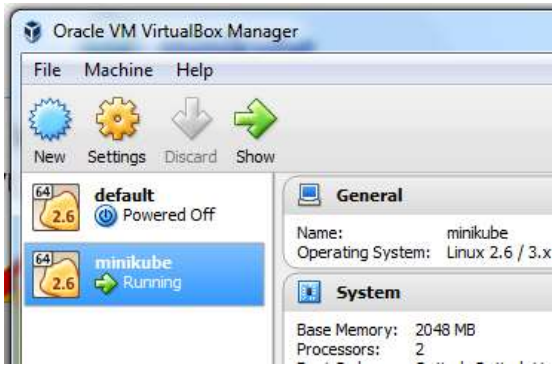
Appendix

Minikube

- Minikube is all-in-one local kubernetes environment
- Works on Linux/Mac/Unix using virtual machine

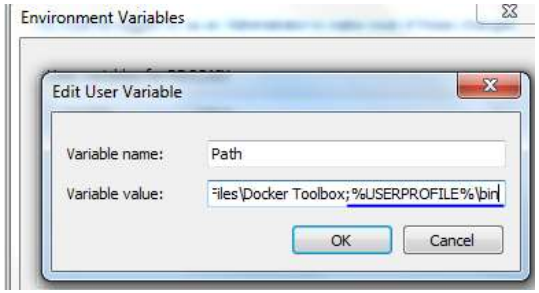


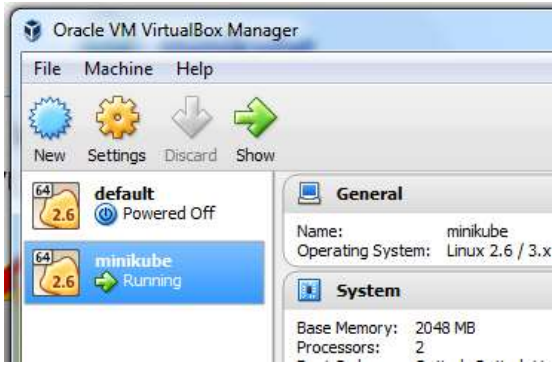




Environment Preparation (Win)

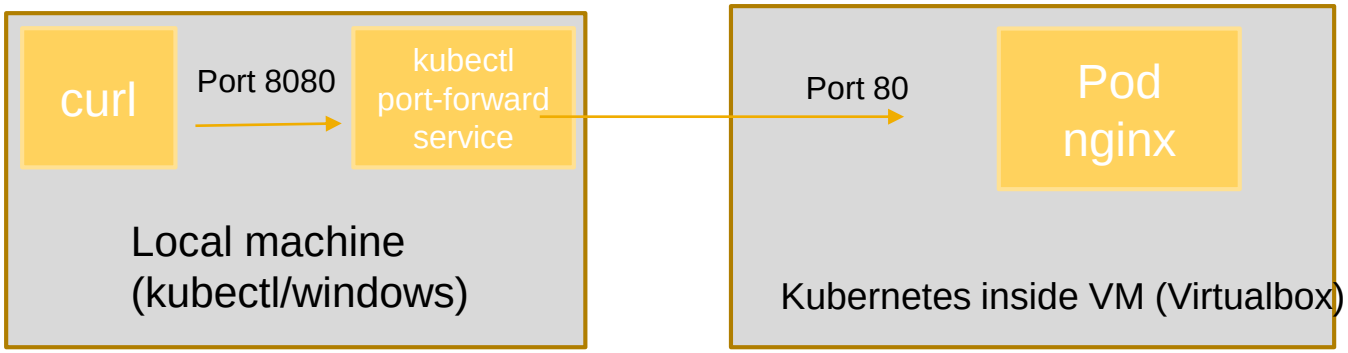
- Using unix env in windows (if not, install Git Windows)
- Minikube + Kubectl
  - Minikube is local installation of kubernetes using VM
  - Kubectl is the client of kubernetes
- Configure PATH (`%USERPROFILE% => /c/Users/<id>`)
- Download
  - `curl -L -o minikube.exe` https://storage.googleapis.com/minikube/releases/latest/minikube-windows-amd64.exe
  - `curl -LO` https://storage.googleapis.com/kubernetes-release/release/v1.7.0/bin/windows/amd64/kubectl.exe
  - `mv minikube.exe kubectl.exe /c/Users/$LOGNAME/bin #$PATH`
- Installation
  - `minikube start --kubernetes-version=v1.7.0`
  - `kubectl version`
  - `minikube config set kubernetes-version v1.7.0`
  - `minikube stop`





Access Pod: Port forwarding

- Forward the local port to the pods without involving service
  - One simple way to get access to container



- kubectl port-forward nginx 8080:80

Exer 2: simple pod to access

- Create the pod nginx2 without deployment
  - `kubectl run nginx2 --image=nginx --port=80 --restart=Never`
  - `kubectl describe pods nginx2`
- Check docker container
  - docker ps
- Access it by using port-forwarding
  - `kubectl port-forward nginx2 8080:80`
  - Use browser to http://localhost:8080
  - `curl http://localhost:8080`
- Dashboard
  - minikube dashboard # check pods/nodes
- Delete
  - `kubectl delete pods nginx2`