Kubernetes + Raspberry pi

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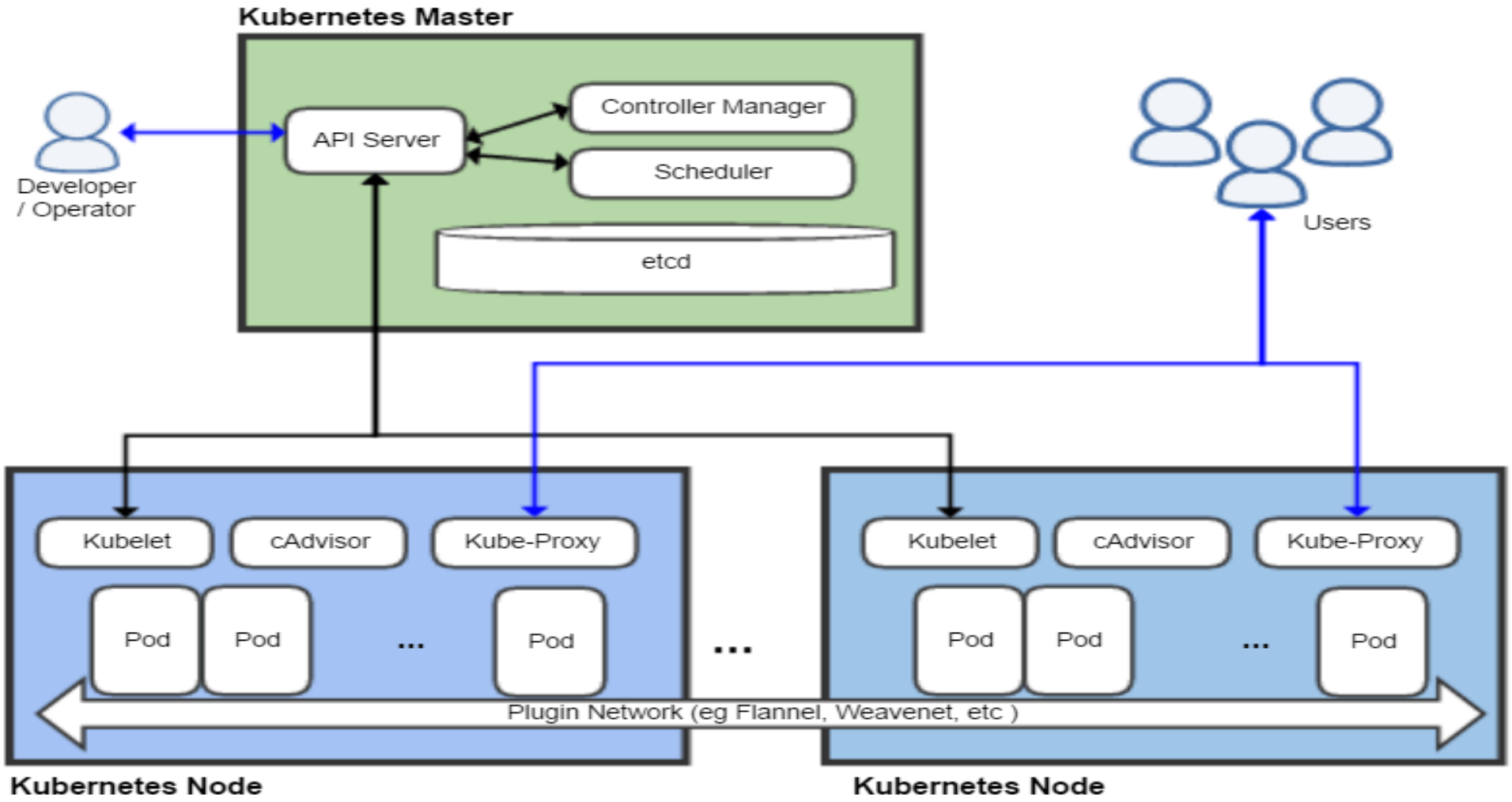
動機

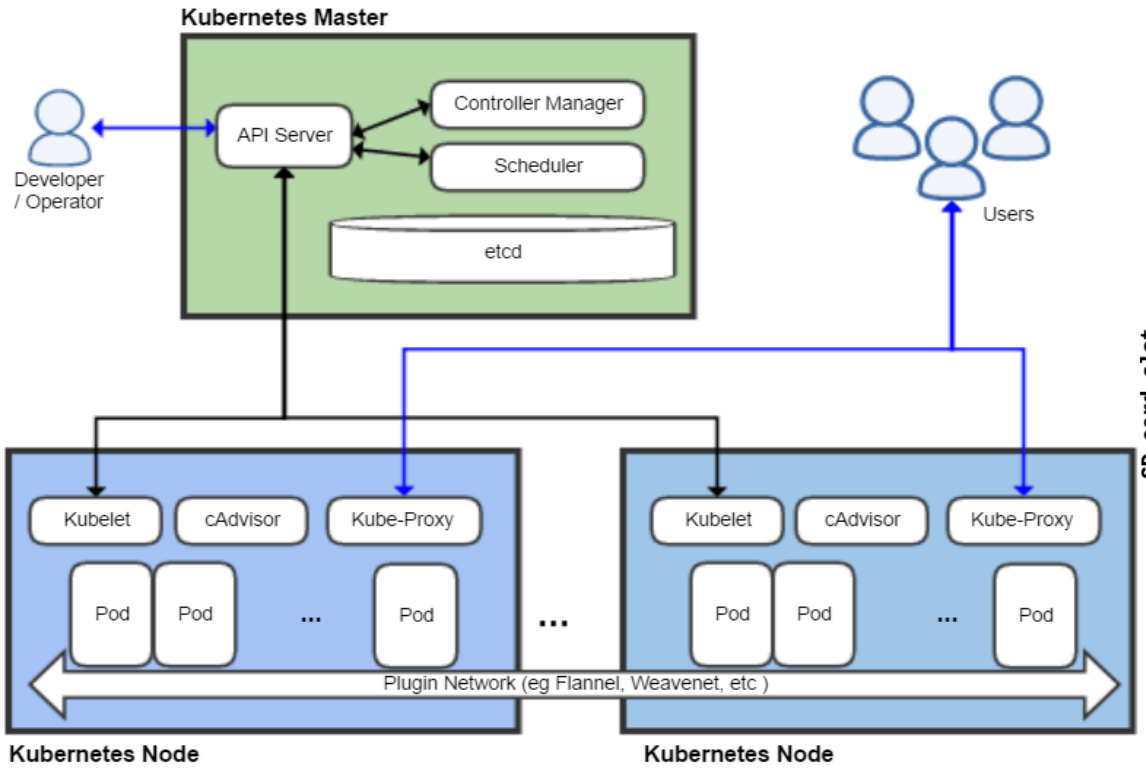
- 近年來輕量級容器的發展已經使開發、打包和部署應用程序的方式都大受影響.而其中在輕量級容器管理的工具中,最受人矚目非Kubernetes莫屬. **Kubernetes** 是用於自動部署、擴展和管理容器化（containerized）應用程式的開源系統.它旨在提供「跨主機集群的自動部署、擴展以及運行應用程式容器的平台」.也因此,本專題打算使用kubernetes以管理Raspberry pi 上的輕量級容器.
- Kubernetes特別適合微服務這樣的架構。Kubernetes也提供了良好的服務發現(Service discovery)機制，讓每個服務彼此可以通信。最重要的是Kubernetes可以提供自動擴展服務，甚至還可以對大規模的容器作滾動更新(Rolling update)以及回滾機制(Rolling back/Undo)
- Kubernetes遵循master-slave .Kubernetes Master是集群的主要控制單元,用於管理其工作負載並指導整個系統的通信. Kubernetes控制平面的各種部件如下：

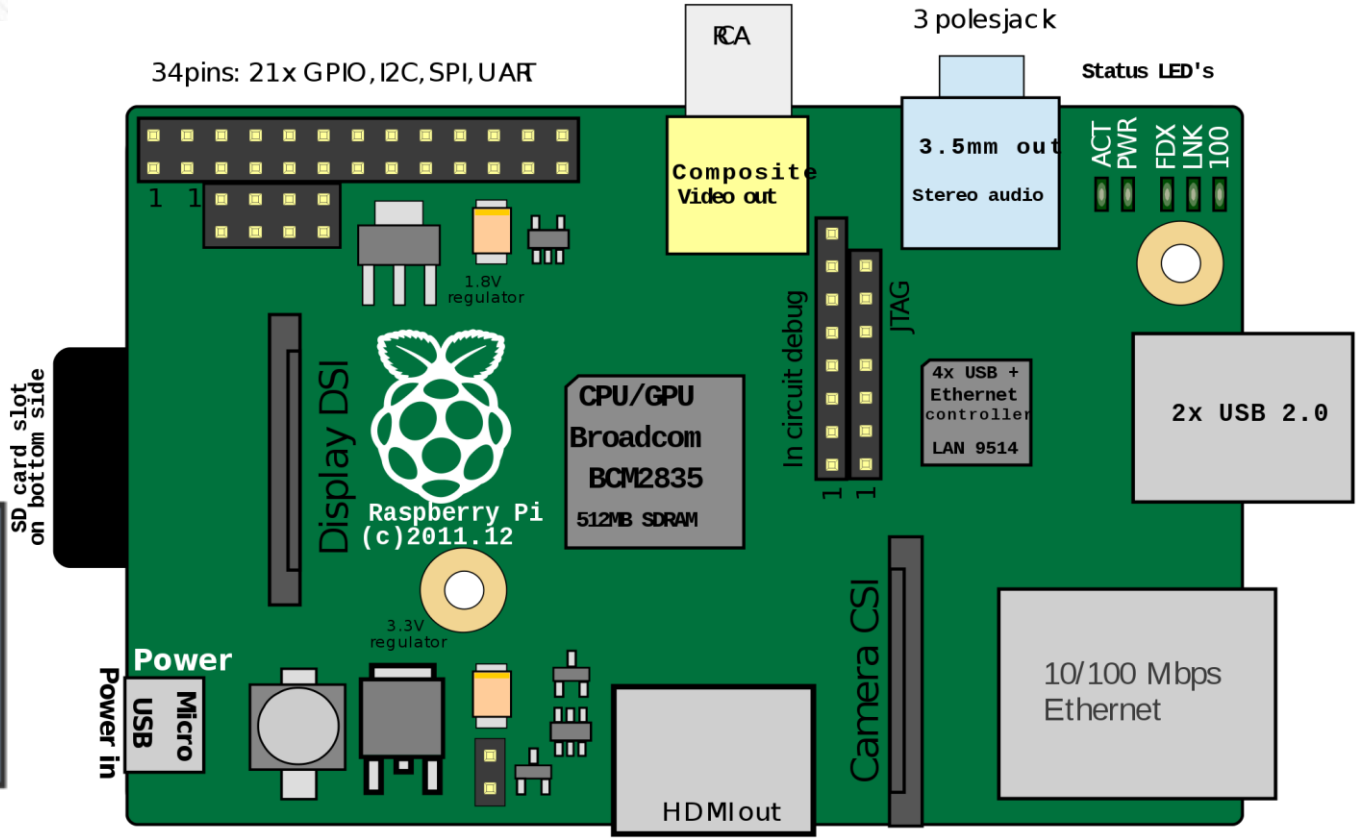
動機


Kubernetes Master
Developer
/ Operator
API Server
Controller Manager
Scheduler
etcd
Users
Kubelet
cAdvisor
Kube-Proxy
Pod
Pod
...
Pod
...
Kubelet
cAdvisor
Kube-Proxy
Pod
Pod
...
Pod
Plugin Network (eg Flannel, Weavenet, etc)
Kubernetes Node
Kubernetes Node

整體目標與成果

主要結構如下圖所示,Master與Node由Raspberry pi來負責





Kubernetes的佈置與研究

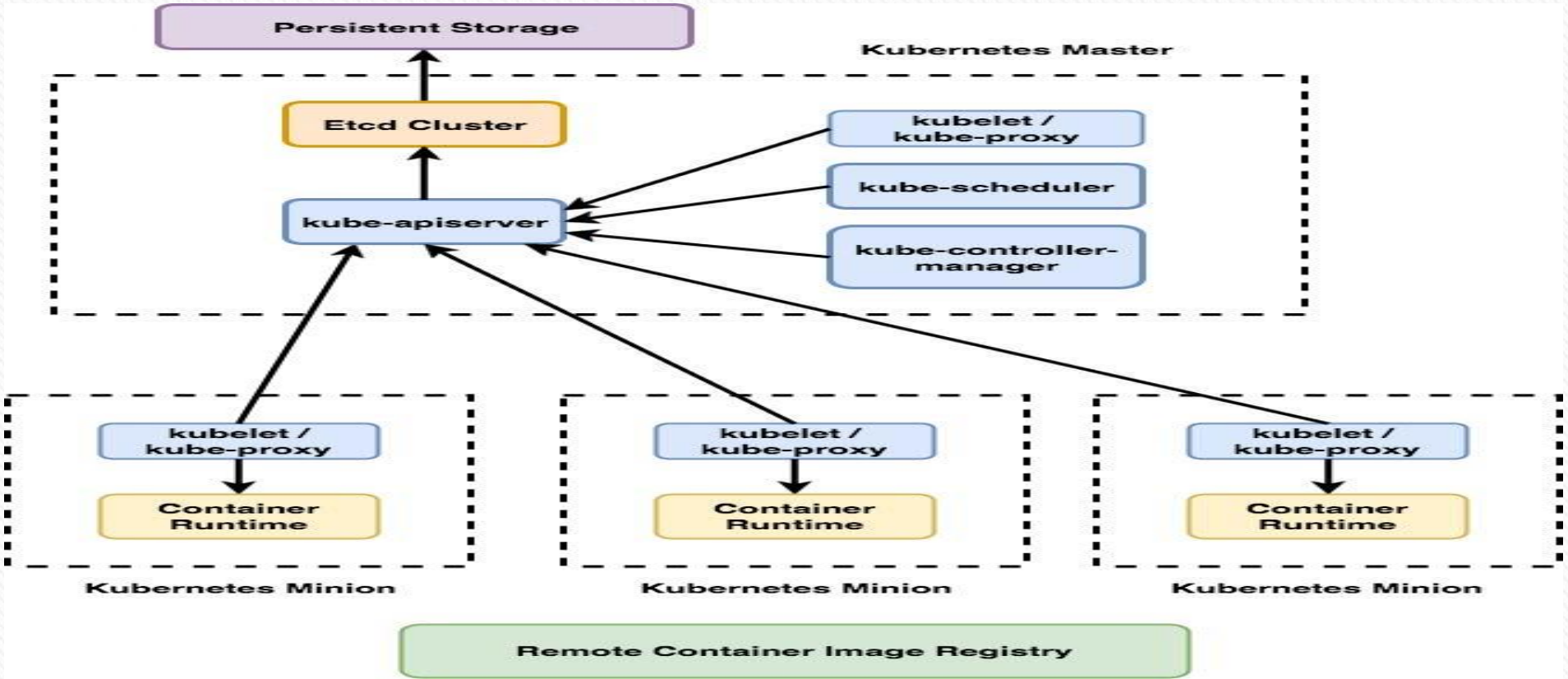
Minikube:單機版

```
/usr/bin/kubectl
--2017-11-30 16:35:29--  https://storage.googleapis.com/kubernetes-release/relea
se/v1.0.1/bin/linux/amd64/kubectl
Resolving storage.googleapis.com (storage.googleapis.com)... 172.217.24.16, 2404
:6800:4008:803::2010
Connecting to storage.googleapis.com (storage.googleapis.com)|172.217.24.16|:443
... connected.
HTTP request sent, awaiting response... 200 OK
Length: 20341304 (19M) [application/octet-stream]
Saving to: ‘kubectl.1’

kubectl.1           100%[===================>]  19.40M  19.7MB/s    in 1.0s

2017-11-30 16:35:30 (19.7 MB/s) - ‘kubectl.1’ saved [20341304/20341304]

root@ubuntu:/home/andychang# kubectl version
Client Version: version.Info{Major:"1", Minor:"8", GitVersion:"v1.8.4", GitCommi
t:"9befc2b8928a9426501d3bf62f72849d5cbcd5a3", GitTreeState:"clean", BuildDate:"2
017-11-20T05:28:34Z", GoVersion:"go1.8.3", Compiler:"gc", Platform:"linux/amd64"
}
The connection to the server 127.0.0.1:8443 was refused - did you specify the ri
ght host or port?
root@ubuntu:/home/andychang# kubectl cluster-info
Kubernetes master is running at https://127.0.0.1:8443
```

Kubernetes的佈置與研究

Kubernetes由許多元件組合而成,而不同的元件又有許多版本,如果欲直接安裝所有元件,版本相容性是一個課題.

藉由安裝kubeadm來實現kubernetes的環境初始化,



Kubernetes的佈置與研究

Kubernetes master初始化

```
Your Kubernetes master has initialized successfully!

To start using your cluster, you need to run the following as a regular user:

  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config

You should now deploy a pod network to the cluster.
Run "kubectl apply -f [podnetwork].yaml" with one of the options listed at:
  https://kubernetes.io/docs/concepts/cluster-administration/addons/

You can now join any number of machines by running the following on each node
as root:

  kubeadm join --token 29191f.c885b4fdcc9e76e6 10.211.55.27:6443 --discovery-token-ca-cert-hash
4628a304648b8aae
```

當有其他node要加入此cluster時, 最下面兩行提供的資訊將派上用場.
接下來我們為了要讓pod能夠互相溝通,我們必須設置pod network.

Kubernetes的佈置與研究

我們可藉由官網:https://kubernetes.io/docs/concepts/cluster-administration/addons/ 所提供的 pod network 選擇其一來設置.
設置完成後,我們可藉由**kubectl get pods --all-namespaces**
指令來得知目前的配置資訊,如下圖所示:

```
root@ubuntu:/home/roborox# kubectl get pods --all-namespaces
NAMESPACE     NAME                                READY     STATUS    RESTARTS   AGE
kube-system   etcd-ubuntu                         1/1       Running   0          10m
kube-system   kube-apiserver-ubuntu               1/1       Running   0          10m
kube-system   kube-controller-manager-ubuntu      1/1       Running   0          11m
kube-system   kube-dns-6f4fd4bdf-9gq7s            0/3       Pending   0          11m
kube-system   kube-flannel-ds-j9l2x               1/1       Running   0          20s
kube-system   kube-proxy-vnrpw                    1/1       Running   0          11m
kube-system   kube-scheduler-ubuntu               1/1       Running   0          10m
```

至此k8s的佈置已經告一段落.
我們可以藉由建立相關的RC定義檔（.yaml）嘗試建立pod以及service,
再利用以下指令:
Kubectl create –f nginx-deployment.yaml
即可生成相關服務的pod.
Kubectl get rc(replication controller)
Kubectl get pods

Kubernetes的佈置與研究

官網提供的方法: Communicate Between Containers in the Same Pod Using a Shared Volume
https://kubernetes.io/docs/tasks/access-application-cluster/communicate-containers-same-pod-shared-volume/

利用.yaml檔建立pod,並在檔案中宣告Shared Volume以及欲建立之containers:
在yaml 檔內定義Pod的結構，這裡使用官方提供的two-container做示範 在yaml裡面設定一個voleme，可視為一個所有container共通的資料夾，接著 在各個container中設立此shared volume的位置。這個範例在debian-container裡面對 這個共用的資料夾創立了一個html檔，並使用nginx-container去呼叫,如下圖所示.

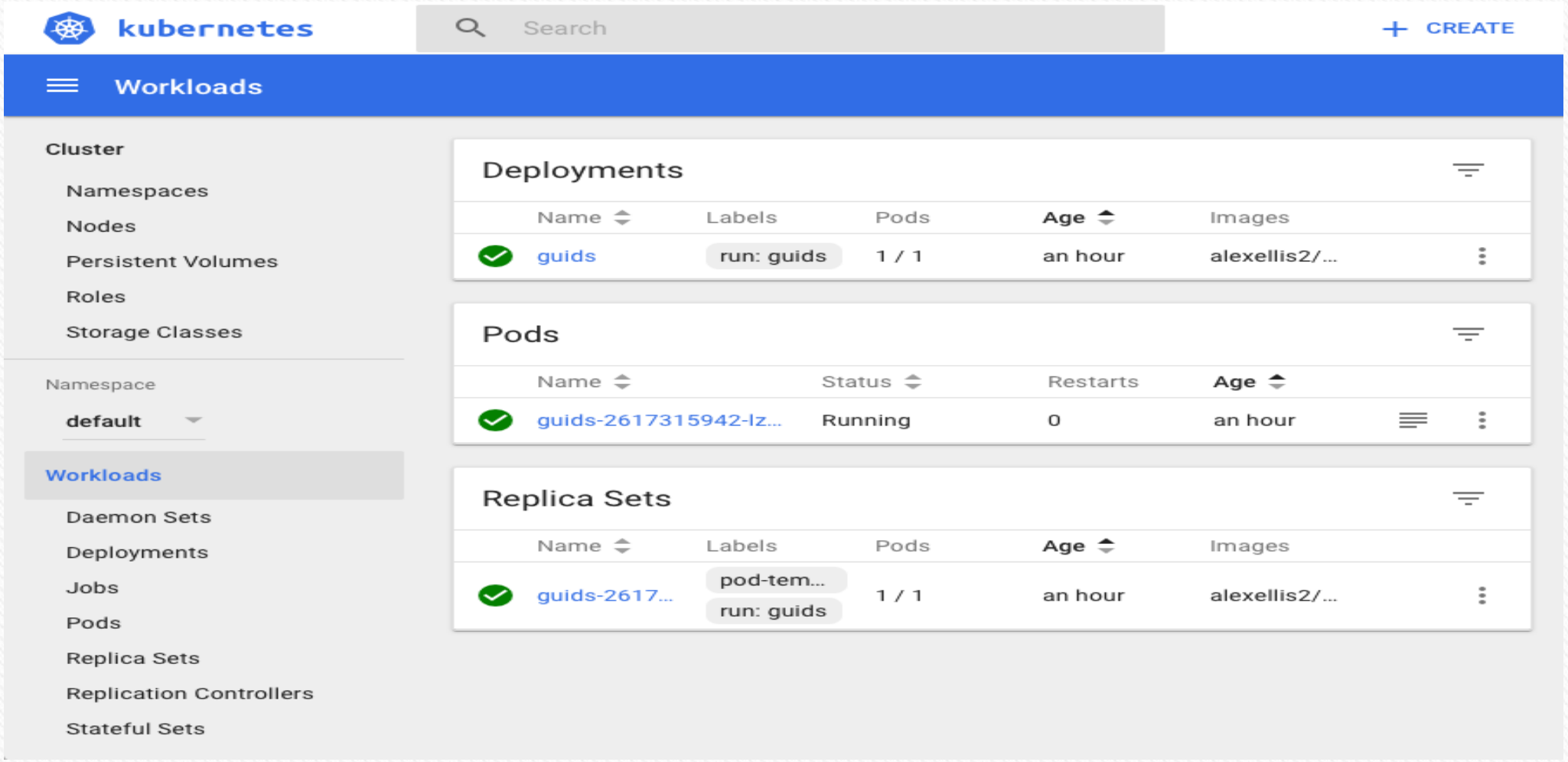
```
apiVersion: v1
kind: Pod
metadata:
  name: two-containers
spec:

  restartPolicy: Never

  volumes:
  - name: shared-data
    emptyDir: {}

  containers:

  - name: nginx-container
    image: nginx
    volumeMounts:
    - name: shared-data
      mountPath: /usr/share/nginx/html

  - name: debian-container
    image: debian
    volumeMounts:
    - name: shared-data
      mountPath: /pod-data
    command: ["/bin/sh"]
    args: ["-c", "echo Hello from the debian container > /pod-data/index.html"]
```

可從另一個container裡面下指令看到另一個container對此shared volume的改動

```
root@two-containers:~# curl localhost
Hello from the debian container
root@two-containers:~#
```

Kubernetes的佈置與研究

Dashboard:可將你kubernetes系統中的狀況顯示出來



Kubernetes的佈置與研究

We can use Kubectl to create and launch Deployments, Replication Controllers and expose them via Services without writing *yaml* definitions

kubectl run http --image=katacoda/docker-http-server:latest --replicas=1
kubectl get deployments
kubectl describe deployment http

The description includes how many replicas are available, labels specified and the events associated with the deployment. These events will highlight any problems and errors that might have occurred

```
$ kubectl get deployments
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
http      1         1         1            0           2s
```

Kubernetes的佈置與研究

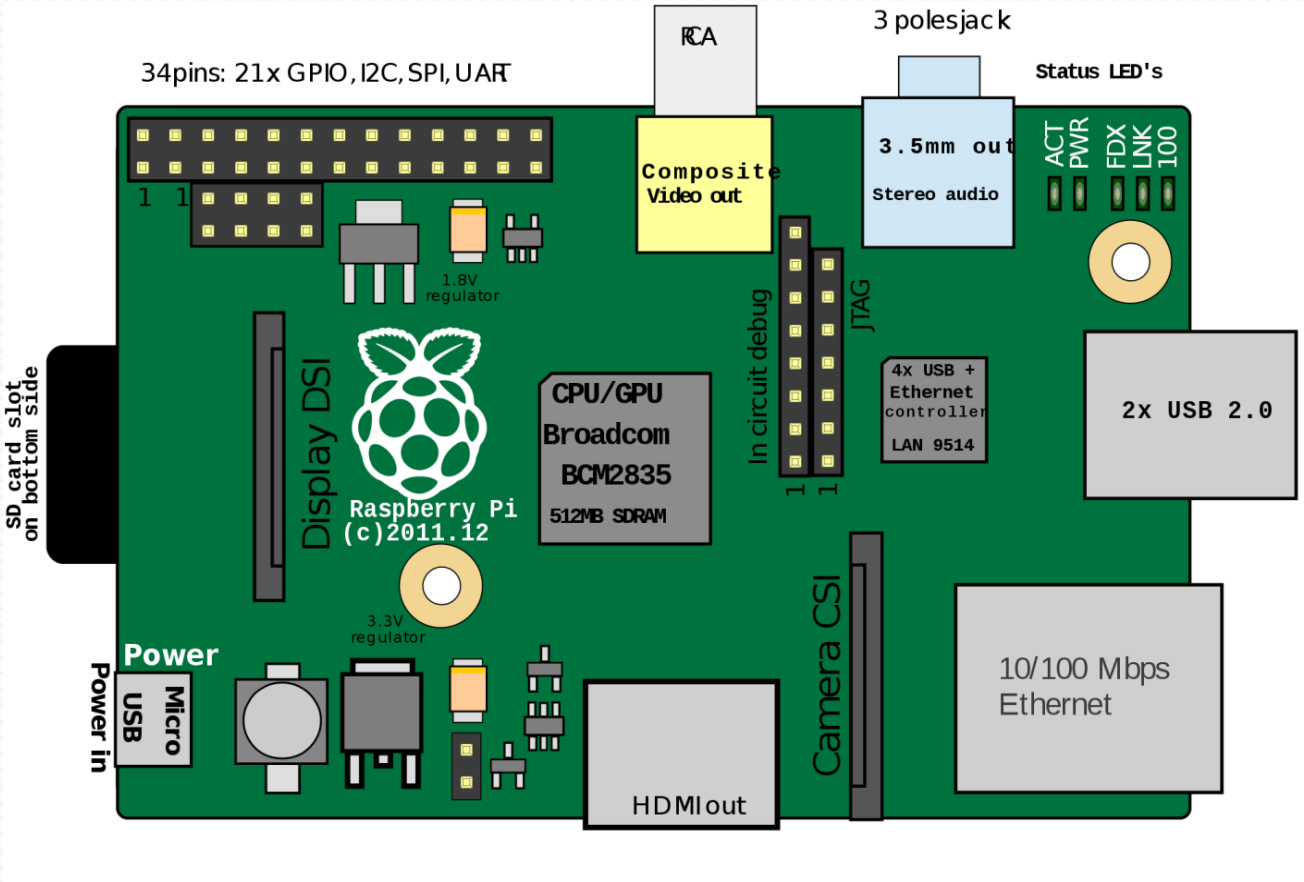
```
izelnakri: ~/kubetest kubectl describe all
Name:                   sweet-toucan-postgresql
Namespace:              default
CreationTimestamp:      Fri, 24 Aug 2018 19:44:07 +0200
Labels:                 app=postgresql
                        chart=postgresql-0.15.0
                        heritage=Tiller
                        release=sweet-toucan
Annotations:            deployment.kubernetes.io/revision=1
Selector:               app=postgresql,release=sweet-toucan
Replicas:               1 desired | 1 updated | 1 total | 1 available | 0 unavailable
StrategyType:           Recreate
MinReadySeconds:        0
Pod Template:
  Labels:  app=postgresql
           release=sweet-toucan
  Containers:
   sweet-toucan-postgresql:
    Image:  postgres:9.6.2
    Port:   5432/TCP
    Requests:
      cpu:      100m
      memory:   256Mi
    Liveness:   exec [sh -c exec pg_isready --host $POD_IP] delay=60s timeout=5s period=10s #success=1 #failure=6
    Readiness:  exec [sh -c exec pg_isready --host $POD_IP] delay=5s timeout=3s period=5s #success=1 #failure=3
    Environment:
      POSTGRES_USER:          postgres
      PGUSER:                 postgres
      POSTGRES_DB:
      POSTGRES_INITDB_ARGS:
```

Kubernetes的佈置與研究

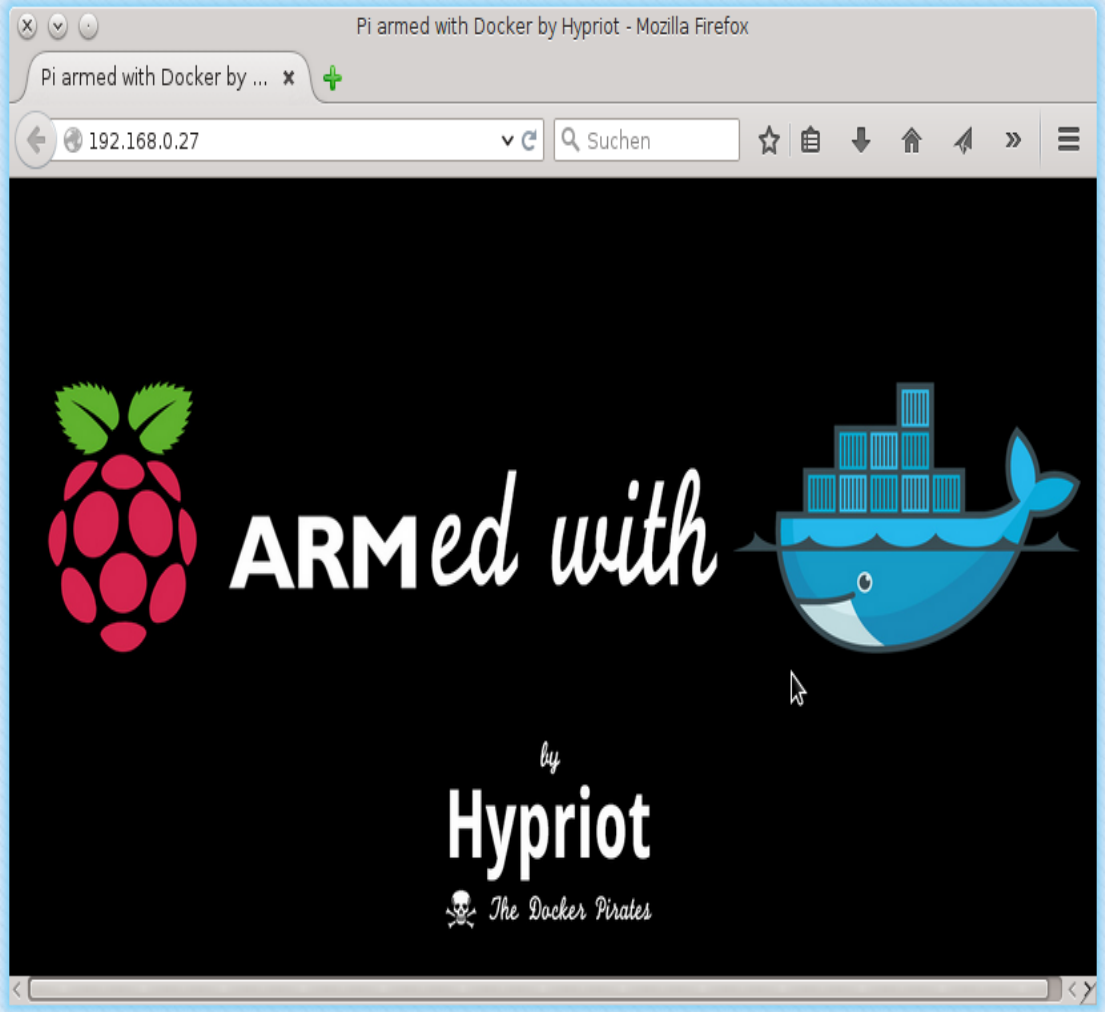
```
$ kubectl get deployments
NAME       DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
http       1         1         1            0           2s
$ kubectl describe deployment http
Name:                   http
Namespace:              default
CreationTimestamp:      Thu, 03 May 2018 08:16:06 +0000
Labels:                 run=http
Annotations:            deployment.kubernetes.io/revision=1
Selector:               run=http
Replicas:               1 desired | 1 updated | 1 total | 1 available | 0 unavailable
StrategyType:           RollingUpdate
MinReadySeconds:        0
RollingUpdateStrategy:  1 max unavailable, 1 max surge
Pod Template:
  Labels:  run=http
  Containers:
   http:
    Image:        katacoda/docker-http-server:latest
    Port:         <none>
    Host Port:    <none>
    Environment:  <none>
    Mounts:       <none>
  Volumes:        <none>
Conditions:
  Type            Status  Reason
  ----            ------  ------
  Available       True    MinimumReplicasAvailable
  Progressing     True    NewReplicaSetAvailable
OldReplicaSets:   <none>
```

在RaspberryPi上安裝Raspbian以及kubernetes

燒錄SD卡以及無限網路設定以及設定node
等等工作來完成Raspberry pi環境的佈置與設定.
.



在RaspberryPi上安装Raspbian.Docker以及kubernetes



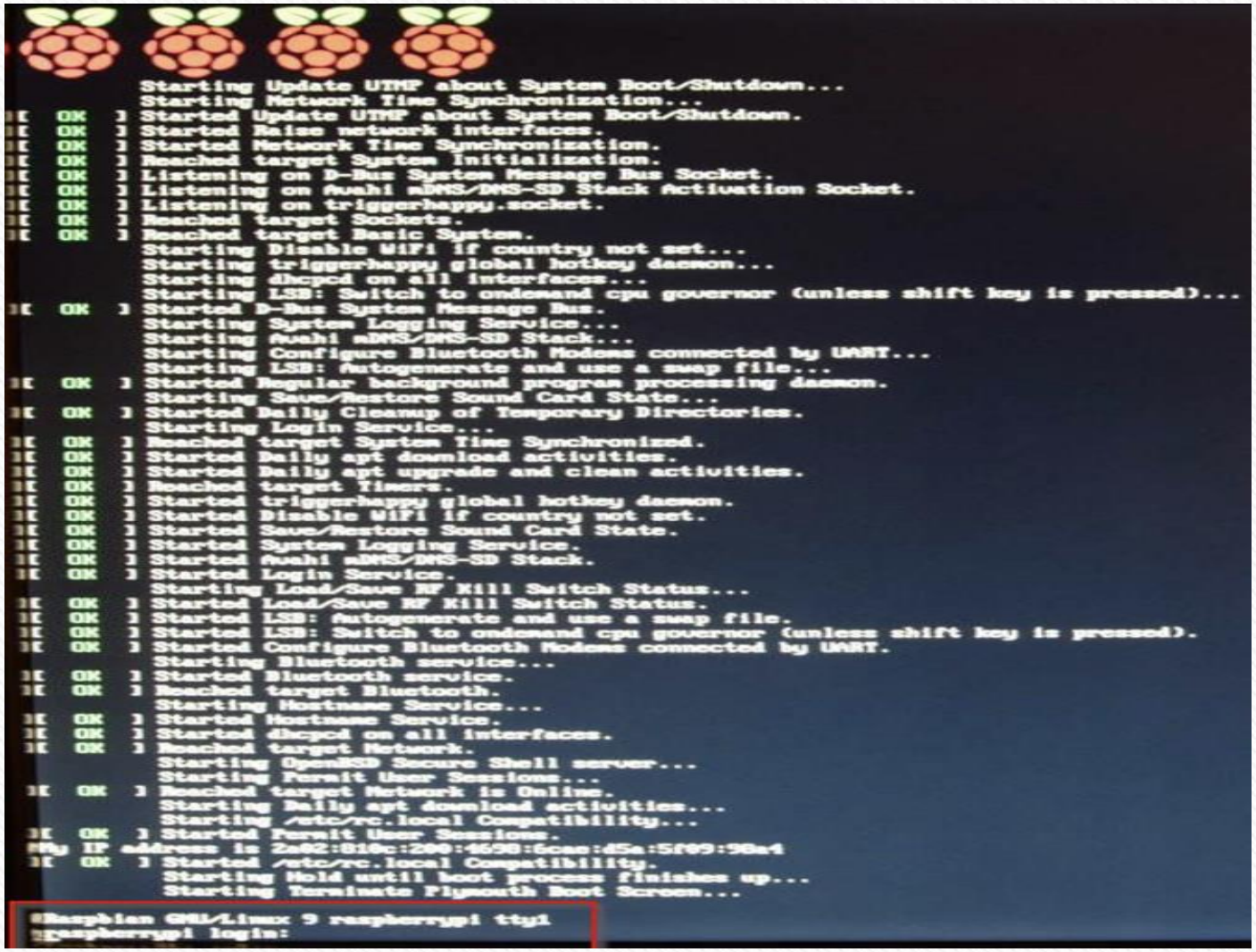
在RaspberryPi上安装Raspbian以及kubernetes

$sudo nano /etc/network/interfaces

```
auto lo
iface lo inet loopback
iface eth0 inet dhcp
allow-hotplug wlan0
#iface wlan0 inet manual
auto wlan0
iface wlan0 inet static
Address
Netmask
Gateway
wpa-ssid
wpa-psk
#wpa-roam /etc/wpa_supplicant/wpa_supplicant.conf
iface default inet dhcp
```

在RaspberryPi上安装Raspbian以及kubernetes

.



在RaspberryPi上安装Raspbian以及kubernetes

```
pi@master:~ $ sudo su
root@master:/home/pi# kubectl get nodes
NAME     STATUS   ROLES    AGE     VERSION
master   Ready    master   4m30s   v1.12.1
root@master:/home/pi# kubectl get nodes
NAME     STATUS   ROLES    AGE     VERSION
master   Ready    master   4m34s   v1.12.1
root@master:/home/pi# kubectl get pods --namespace=kube-system
NAME                             READY   STATUS    RESTARTS   AGE
coredns-576cbf47c7-nh77j         1/1     Running   0          4m27s
coredns-576cbf47c7-s47n9         1/1     Running   0          4m27s
etcd-master                      1/1     Running   0          4m31s
kube-apiserver-master            1/1     Running   0          4m36s
kube-controller-manager-master   1/1     Running   0          4m31s
kube-proxy-vn2ks                 1/1     Running   0          4m27s
kube-scheduler-master            1/1     Running   0          4m36s
weave-net-mxrmv                  2/2     Running   0          3m20s
root@master:/home/pi#
```

在RaspberryPi上安装Raspbian以及kubernetes

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: two-containers
spec:

  restartPolicy: Never

  volumes:
  - name: shared-data
    emptyDir: {}

  containers:

  - name: nginx-container
    image: nginx
    volumeMounts:
    - name: shared-data
      mountPath: /usr/share/nginx/html

  - name: debian-container
    image: debian
    volumeMounts:
    - name: shared-data
      mountPath: /pod-data
    command: ["/bin/sh"]
    args: ["-c", "echo Hello from the debian container > /pod-data/index.html"]
```

在RaspberryPi上安装Raspbian以及kubernetes

Operation	Syntax	Description
annotate	kubectl annotate (-f FILENAME | TYPE NAME | TYPE/NAME) KEY_1=VAL_1 ... KEY_N=VAL_N [--overwrite] [--all] [--resource-version=version] [flags]	Add or update the annotations of one or more resources.
api-versions	kubectl api-versions [flags]	List the API versions that are available.
apply	kubectl apply -f FILENAME [flags]	Apply a configuration change to a resource from a file or stdin.
attach	kubectl attach POD -c CONTAINER [-i] [-t] [flags]	Attach to a running container either to view the output stream or interact with the container (stdin).
autoscale	kubectl autoscale (-f FILENAME | TYPE NAME | TYPE/NAME) [--min=MINPODS] --max=MAXPODS [--cpu-percent=CPU] [flags]	Automatically scale the set of pods that are managed by a replication controller.
cluster-info	kubectl cluster-info [flags]	Display endpoint information about the master and services in the cluster.
config	kubectl config SUBCOMMAND [flags]	Modifies kubeconfig files. See the individual subcommands for details.
create	kubectl create -f FILENAME [flags]	Create one or more resources from a file or stdin.
delete	kubectl delete (-f FILENAME | TYPE [NAME | /NAME | -l label | --all]) [flags]	Delete resources either from a file, stdin, or specifying label selectors, names, resource selectors, or resources.
describe	kubectl describe (-f FILENAME | TYPE [NAME_PREFIX | /NAME | -l label]) [flags]	Display the detailed state of one or more resources.
edit	kubectl edit (-f FILENAME | TYPE NAME | TYPE/NAME) [flags]	Edit and update the definition of one or more resources on the server by using the default editor.

Reference

- https://tutorials.ubuntu.com/tutorial/install-kubernetes-with-conjure-up#0
- https://kubernetes.io/docs/setup/independent/install-kubeadm/
- https://kubernetes.io/docs/setup/independent/create-cluster-kubeadm/
- https://kubernetes.io/docs/concepts/cluster-administration/addons/
- https://kubernetes.io/docs/tasks/access-application-cluster/communicate-containers-same-pod-shared-volume/
- https://kubernetes.io/docs/tasks/run-application/run-stateless-application-deployment/
- https://blog.hypriot.com/post/setup-kubernetes-raspberry-pi-cluster/8.
- https://kubernetes.io/docs/tasks/access-application-cluster/web-ui-dashboard/
- https://kubernetes.io/docs/reference/kubectl/docker-cli-to-kubectl/

Reference

http://docs.kubernetes.org.cn/312.html

https://www.ithome.com.tw/news/122908

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